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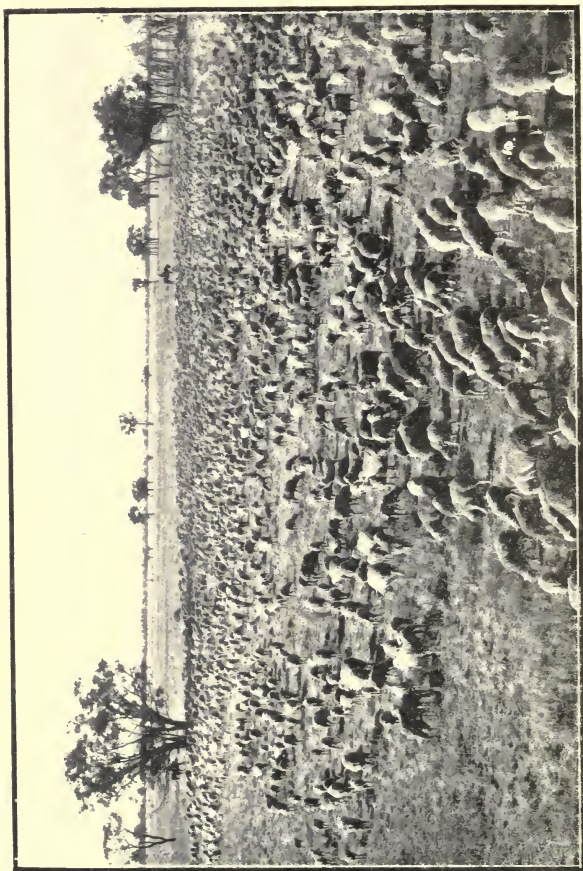
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Scene on an Australian Sheep Station -- Sheep Grazing on the Natural Pastures.

Australian Grasses and Pasture Plants

With Notes on Native Fodder Shrubs and Trees

BY

FRED TURNER, F.L.S., F.R.H.S., etc.

Author of the following Government Publications (Illustrated and Descriptive):—

The Grasses of New South Wales; Indigenous Forage Plants of Australia (non-grasses);

Australian Grasses; West Australian Grasses; West Australian Salsolaceous Plants;

New Commercial Crops for New South Wales; Supposed Poisonous Plants of New South Wales;

Suspected Poisonous Plants of West Australia; Noxious Introduced Weeds of New South Wales;

An Ecological Study of One Hundred Species of Queensland Grasses

DRAWINGS BY MARY I. TURNER



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FOREWORD.

TO write an original, reliable, and popular work on the important subject of Australian Grasses and Pasture Plants for the information of stock-owners and all those settled upon the land in this great southern continent is a serious and onerous undertaking, more especially when the space is limited to a certain number of pages. Although the matter contained in this little volume is concisely written accuracy has not been sacrificed, for the information is based upon my own scientific and practical experience and long observation of the economic value of some of the best and most widely distributed grasses and forage plants growing in Australian pastures.

The matter contained in the following pages may be regarded as a sequel to those illustrated and descriptive larger and more comprehensive works on Australian Grasses and Forage Plants, which I wrote under instructions from the Governments of New South Wales, Queensland, and West Australia.

FRED TURNER.

SYDNEY, 1921.

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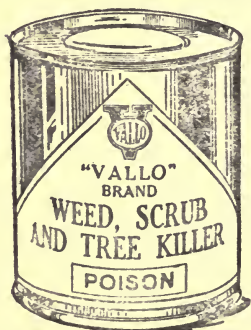
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M E L B O U R N E

Australian Grasses and Pasture Plants

INTRODUCTORY

Australian grasses attracted much attention from the discoverers and the earliest settlers on the land, and different views were entertained regarding their economic importance. Sir Joseph Banks, to whom Australia is so much indebted for its early settlement, and for the development of its vegetable resources, remarked in one of his reports :—"The herbage of the colony is by no means so well adapted to sheep-farming as that of Europe, and, therefore, the progress of the flocks will be slow." This opinion, however, was soon controverted, for Captain Waterhouse, writing to Captain Macarthur (two pioneers in the pastoral industry) in the early part of the last century, mentioned that he had kept sheep, and found them do well on the natural pasturage, and he believed that good pasturage would be found for any number of sheep that might be raised. He therefore ridiculed the idea of the necessity of introducing exotic grasses. The opinions entertained by Captain Waterhouse, more than one hundred years ago, have been amply verified by subsequent experience. Australian explorers always took great interest in the indigenous grasses which, when abundant, relieved them of much anxiety in providing good feed for their horses and for the stock that travelled with them. Sir Thomas Mitchell, exploring in the interior, collected specimens of grasses, and afterwards wrote an interesting account of the manner in which the aborigines gathered the "Australian Millet" (*Panicum decompositum*) the seeds of which formed for them

an important article of food. He, *inter alia*, writes :—"The grass had been pulled up to a very great extent and piled in hay-ricks, so that the aspect of the desert was softened into the agreeable semblance of a hay field. The grass was beautifully green beneath the heaps and full of seeds, and our cattle were very fond of this hay." Since the introduction of sheep farming in Australia, a little more than a century ago, the pastoral industry has gradually increased in importance, and is now estimated to be worth about £250,000,000 sterling, and yearly increasing in value, being the most important in Australia, and the one from which the population derives its greatest wealth. It is, therefore, a matter of national importance that more attention should be devoted to the valuable indigenous grasses and other pasture herbage, and that its great economic value should be more generally known to stockowners. For without that rich and varied vegetation, which is the most valuable asset in Australia, it would be practically impossible to feed the millions of sheep, cattle and horses now pastured on this continent. As far as is at present known there are three hundred and seventy species and many varieties of grass indigenous to Australia, and they are fairly well distributed over the continent, quite a number occurring on the so-called desert tracts of Central Australia. Some of these attain a height of from eight to ten feet or more, but by far the greater number grow, under normal conditions, from one foot to four feet high. All these grasses, of course, are not valuable feed for stock, and although the inferior ones have their uses in the economy of Nature, further reference to them is not necessary in this book.

Having travelled more than fifty thousand miles in Australia during the last forty years, and having critically examined much of the indigenous vegetation in all the States of the Commonwealth and in other countries, and having

cultivated in an experimental way, over a series of years, upwards of one hundred species of Australian grasses together with the best that could be obtained in Europe, Asia, Africa, and America, to test their drought enduring properties and other qualities by comparison, I can conscientiously say that no part of the world possesses richer and more varied pasture vegetation than Australia, and if careful attention is given to it, and judicious stocking is practised, the grasses and other herbage will maintain their vigour and economic value indefinitely. Some years ago stock-owners in various districts thought to improve the grazing capacity of their pastures by sowing seeds of the so-called English grasses. These succeed well enough in those parts of Australia which have a climate and rainfall somewhat similar to those of Northern Europe, but these comprise an exceedingly small area in comparison with the whole of the continent. To sow such grass seeds on most of the grazing areas in this country would simply be courting failure. Very few stock-owners are aware that an acre well clothed with grass contains from fifteen to twenty million plants, though in some exceptional cases as many as forty million plants have been recorded to the acre. Nor are they aware that the number of grass seeds required to sow an acre, supposing it to be sown at the rate of forty pounds is approximately twenty-two millions. This applies to ordinary grasses as, for example, the different species of *Eragrostis* and *Panicum*. It will be gathered from these facts that in order to maintain good stock feed, the natural pastures should be systematically attended to. To accomplish this every pastoral holding should be divided into paddocks, which should be grazed in rotation, and each paddock should have at least three or four months' rest every year, and particularly for a period during seeding time. By this method not only would the herbage recuperate, but it would have an opportunity of producing seed, which in due

course would fall to the ground and germinate, and new plants would result and so perpetuate good pasturage.

Seed Producing Properties of Australian Grasses.—

Most of the indigenous grasses, when allowed to grow undisturbed for a time, produce an abundance of seed which when mature and kept in contact with dry earth retain their germinating power for a lengthy period. Several species produce seeds which are comparatively large when compared with those of cultivated cereals, and which at one time formed an important article of food for the aborigines. The ripe seeds of many indigenous grasses are enclosed in very hard coverings with the lower portions prolonged into points. When mature these seeds fall perpendicularly to the ground, penetrate it, and gradually descend several inches, especially if it is deep and loose. The sharp-pointed seeds of the "tall oat grass" (*Anthistiria avenacea*) have been found nearly a foot below the surface, so that it is easy to understand how the ground is often thickly studded with the seeds of various grasses. This method of sowing grass seed is one of the many devices Dame Nature adopts for perpetuating plants under adverse climatic conditions. When good rains fall on these naturally-sown areas, and genial weather ensues, the seeds germinate quickly, and the resulting grass grows rapidly and soon clothes apparently useless tracts of country with beautiful verdure.

Drought Enduring and Recuperative Powers of Australian Grasses.—

Many of the native grasses have bulbous or thick knotty bases, which no doubt are provided by Nature for storing up food to sustain the plants during very dry weather, and to preserve them from extinction. In adverse seasons and during prolonged droughts, when every vestige of grass foliage has disappeared, these swollen bases, which are generally enveloped in a woolly substance to prevent evaporation,

and their strong, long, fibrous roots, which penetrate deeply into the earth, remain alive but dormant until the condition of the soil and weather are favourable for them to again put forth green leaves. In January, after a heavy fall of rain, I have seen the dormant, woolly, swollen bases of the "tall oat grass" develop stems and leaves, and in four months plants more than six feet high, producing a remarkable amount of rich, succulent herbage. That occurred on some of the country west of the Darling River, but on the black soil plains near Moree I have seen that fine grass nearly nine feet high, and that wonderful growth was made in less than five months after heavy summer rain, followed by favourable weather. Several species, peculiar to the interior, of the genus *Eragrostis* have large bulbous bases from which a number of stems and leaves develop after rainfall, no matter how prolonged the previous dry weather may have been. *Eragrostis eriopoda* and *E. laniflora* are two very remarkable plants in that particular. An allied species (*E. lacunaria*) is popularly called "never fail" by stockmen, on account of the phenomenal amount of dry weather it can withstand. One of the "mulga" grasses (*Danthonia bipartita*) has a large bulbous base and strong fibrous roots, which enable the plant to withstand the torrid heat of Central Australia. After rain quite a number of growths, generally not more than one foot, and rarely exceeding two feet in height, are produced from its base, and the leaves remain vividly green for a considerable time, even if a long period of dry weather ensues. The "Mitchell grasses" (*Astrebla spp.*) occupy large tracts of country in the interior and have thick, knotty bases, which, together with the strong, wiry roots, that penetrate deeply into the earth, remain in a dormant condition during protracted droughts, but readily start into growths after a good rainfall. These valuable pasture grasses, more particularly (*Astrebla elymoides*), have a branching habit, and in an

ordinary season a good shower of rain, such as results from a thunderstorm, will cause new growth to sprout prolifically from the joints of the stems, which are soon covered with a mass of green nutritious herbage. The above are only a very few of the many instances which could be given to illustrate the remarkable recuperative powers of Australian grasses.

Improvement of Pastures.—On sheep runs the fact that every animal and the fleece of wool that it produces annually takes a certain percentage of chemical substances out of the earth is often lost sight of and little or nothing so far has been done to restore these elements to the soil, except that which is returned in a natural way, but these should be taken into consideration for they are of primary importance in maintaining good pasturage. In the dairying districts few dairymen take into account that a very large amount of nutritious herbage is required to build up the frame and body of young cattle, and also that every gallon of milk takes a certain amount of fertility out of the land. Until this is restored to the soil in some form or another the pasturage, both as regards quantity and quality, must deteriorate sooner or later. Amongst a number of chemical constituents that grasses and fodder plants remove from the soil, the most valuable are nitrogen, phosphoric acid, potash, and lime. These should be returned to the land in the form of dried blood, bonedust, kainite, or similar manures. The proportion to use will, of course, depend upon local and other conditions, and must be determined by those who use them. Some soils are naturally richer in one or more of these constituents than others are, and when this has been chemically ascertained the proportion to apply to the land can be gauged to a nicety, and fertilisers can be used economically and efficiently. In some pastures in the coast areas chain harrows have been employed to pulverise and evenly distribute over the grass the

refuse from dairy stock, and the results have already justified the labour. This innovation is a decided advance in the improvement of pastures, and might be more generally practised with advantage on all the grazing areas in the Commonwealth devoted to dairy cattle.

Pasture Herbs that Provide Good Feed for Stock.—In Australia there are large numbers of herbs, other than grasses, that form a good percentage of the indigenous herbage on many sheep and cattle stations. Owing to their varied character—for there are representatives of many different families of plants—these nutritious fodder herbs are a most important factor in making Australian native pastures rich feeding grounds for all kinds of herbivora. Moreover, the succulent stems and leaves of many of these plants assuage the thirst of the animals that eat them. Many of these herbs have long, strong roots, which penetrate deeply into the earth, and enable the plants to withstand a long period of dry weather, without any appreciable check to their growth. When not too closely fed over, they produce an abundance of seed which germinates readily under ordinary conditions, and so they are fairly plentiful in many parts of the country. Most of them are herbaceous plants, and many of upright habit, growing about one foot high, while several have prostrate stems, which lengthen considerably in good seasons.

The Importance of Salt-Bush to the Pastoral Industry.—When sheep and cattle were first removed from the coast areas, and pastured on the great inland plains, observant stockmen were not long in finding out that the animals kept in excellent condition, and that where salt-bush formed a good percentage of the herbage, sheep that had been suffering from distoma diseases, fluke, for example, were eventually cured of these intestinal parasites. Although during the early days

of pastoral occupation salt-bushes were so highly valued as feed for sheep and cattle, no attempts were made to systematically conserve them ; consequently they are not nearly as plentiful in many parts of the interior as formerly. Many pastoralists, however, profiting by previous mistakes, are now fully convinced of the necessity of conserving these valuable forage plants, which have provided such excellent feed for stock, even during adverse seasons, and several experienced graziers are now going so far as to cultivate them. A good percentage of salt-bushes in the pastures enhances the grazing capabilities of the country, and keeps stock in a healthy condition; moreover, their succulent stems and leaves assuage the thirst of the animals that browse upon them—a most important consideration in country where water is scarce. All these plants are easily raised from seed, and many can be increased by cuttings, so that there are no insurmountable difficulties in increasing this valuable pasture herbage. The succulent stems and leaves of several salinous plants are good table esculents when cooked and served in the ordinary way. Some species attain a height of from six to twelve feet or more, and others of from three to four feet, but the greater number grow from one foot to two feet high, while several have creeping stems which sometimes cover the ground for a considerable area with rich, succulent herbage. Very few plants so useful for forage purposes can exist under such adverse conditions of drought and heat as most members of the salt-bush family. When well established they are exceedingly tenacious of life, and the hotter the season the more luxuriantly many of them grow, provided they are not persistently eaten over. Chemical analyses of Australian salt-bushes made in New South Wales, and in California, where considerable attention has been devoted to their cultivation, agree in assigning to them a high feeding value. Though different species vary considerably it may be stated that as a general rule the best kinds, when

freshly cut, contain about seventy-five per cent. of water, four to six per cent. of fats, about two point three per cent. of albuminoids, ten per cent. of digestible carbohydrates, three to four per cent. of woody fibre, with a very high percentage of ash, of which half is common salt, ranging from five to ten. In comparison with other forage plants, salt-bushes are richer than barley, maize, oats, or sorghum fodder, weight for weight, and are nearly equal to lucerne and the best meadow hay. Their nutritive ratio is one to four, proving that they are a rich food, as they contain one part of flesh-forming substances to four of heat-giving materials, and thus furnish a well balanced ration for fattening pasture animals.

Edible Shrubs.—Any account of the grasses and forage plants of Australia would be incomplete without a mention of the indigenous shrubs and trees whose foliage provide good feed for stock. In its virgin state a fair percentage of the interior that is now devoted to grazing consisted of vegetation that was largely composed of drought enduring shrubs—scrubs as stockmen call them—growing from three to fifteen feet high or more, the leaves of which provided good feed for herbivora when the more tender pasture herbage became scarce during prolonged periods of dry weather. It has long been proved by practical experience that that kind of vegetation, when fairly plentiful, is of the greatest importance, and it is therefore considered a most valuable asset on any station. The constant feeding over of the dwarf shrubs, the periodical lopping and cutting down of numbers of the taller ones as feed for stock, and the ringbarking of thousands of others by rabbits, have had a serious effect upon the stock carrying capacity of immense areas of country in dry seasons. In many districts this very useful vegetation which was once plentiful has now become scarce, and it would be wise to conserve it, where it is already growing, and replant

it where it has disappeared. Many experienced stock-owners have informed me that in the early days of pastoral occupation, when the shrubby vegetation was a prominent feature on their grazing areas, ordinary droughts had no great terror for them, as most kinds of pasture animals thrive and kept in good condition on it until rain fell and the more tender and nutritious herbage again became plentiful. Although this shrubby vegetation is so highly appreciated by experienced pastoralists no systematic attempts have been made to conserve it on a large scale, but it would be well worth doing, for one must never lose sight of the fact that the rainfall in many parts of the interior is uncertain. A simple method of conservation could be initiated by fencing with rabbit-proof netting some of the best areas, and only allowing stock access to them when the more tender plants had temporarily disappeared. Even then stock should be judiciously fed on the leaves of these shrubs, and no unnecessary destruction permitted. In addition to conserving the existing shrubs, such fenced-in areas would be the best possible protection to any seedlings that might spring up, and so those most useful forage plants would be perpetuated indefinitely. When lopping the taller-growing shrubs that do not bear pruning well some of the smaller branches only should be cut, so that those left will keep the roots active and the sap in circulation. This will conduce to the formation of new growth, and so prolong the life of the plant.

The Importance of Native Trees to the Pastoral Industry.—Many trees of economic value and of great importance to the pastoral industry, inasmuch as their leaves provide good feed for stock during prolonged periods of dry weather, grow in more or less abundance over immense tracts of country on the droughty inlands. In addition to producing feed for the animals they provide them with grateful shade from the fierce heat of the sun in summer, and shelter from the cold

winds of winter. Moreover, this arboreal vegetation when fairly plentiful mitigates the scorching effects of the hot winds on the more tender herbage, preserves the surface moisture from too rapidly evaporating, and in a great measure prevents wind storms from disturbing or removing the loose surface soil ; thus playing a most important part in the economy of Nature. Trees that provide good feed for stock during adverse seasons should be looked upon as a valuable pastoral, indeed a national asset. Droughts will recur at certain intervals, and some of them in the natural order of events will be more intense than others ; then pastoralists who have on their properties large numbers of good fodder trees and edible shrubs, that endure long periods of dry weather with impunity, will be enabled to keep their stock from starving until the return of more propitious seasons, when the nutritious grasses and succulent herbage again become plentiful. If a good fodder tree or shrub is cut down new growth rarely springs from the stump, consequently it is lost for ever; whereas, if it were judiciously lopped it would remain a pastoral asset and supply stock feed for future requirements.

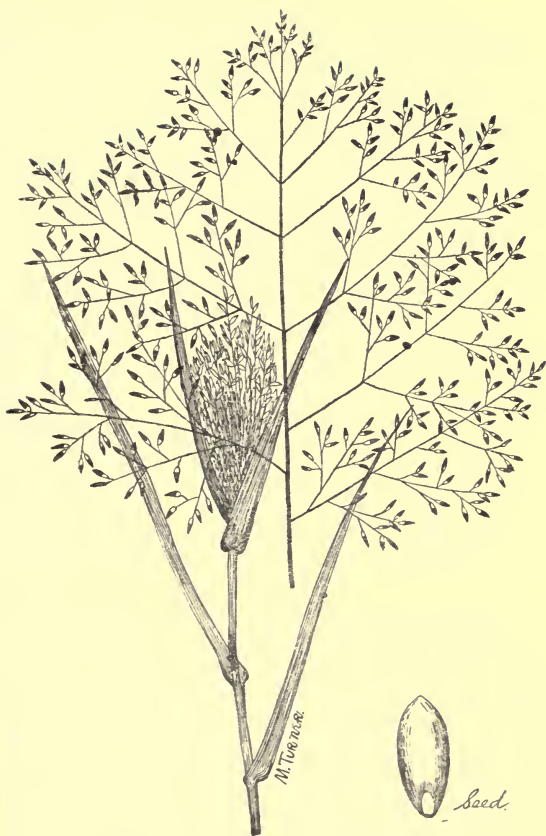
Storing Fodder for Feeding Stock in Adverse Seasons.—

In propitious seasons millions of acres in the interior are covered with grass and other herbage often to a depth of three feet or more. At such time stock have much more feed than they can consume, and immense quantities of rich herbage are often trampled down by the animals' hoofs, and when dry it becomes pulverised and rendered useless. Several enterprising stock-owners have cut quantities of the growth when superabundant in their pastures and turned it into hay or ensilage at comparatively small cost, and this has proved a valuable stand-by for stock in adverse seasons. This method of conserving the surplus herbage might with advantage be more generally adopted, for every ton of fodder preserved is not only a local but a national asset.

GRASSES.

All the grasses and pasture plants described in the following pages are of perennial duration unless otherwise stated.

Australian Millet (*Panicum decompositum*) is found all over the continent from the coast to the centre, and in some districts is very plentiful. It withstands dry weather to a remarkable degree, and has wonderful recuperative powers, being amongst the first native grasses to start into growth after rain supervening on long drought. It is a perfectly smooth grass of spreading habit, generally growing from two to three feet high, but on rich moist land it may occasionally be seen growing four feet high. In the latter situation it has long, flat and rather broad leaves, but on the inland plains its leaves are narrower. It yields most valuable herbage of which stock of all kinds are remarkably fond, and on which they fatten. I have had this grass under experimental cultivation for several years, and the amount of herbage it yielded in a few months was really astonishing. The hay that was made from it was equal to three tons per acre, and horses and cattle were very fond of it. I can highly recommend it for systematic cultivation either in the coast areas or in the interior. When allowed to grow undisturbed for a time it produces a great amount of seed which germinates readily under ordinary conditions. The seeds usually ripen during the summer and autumn. An illustration of the Australian Millet accompanies this letterpress.



Australian Millet.

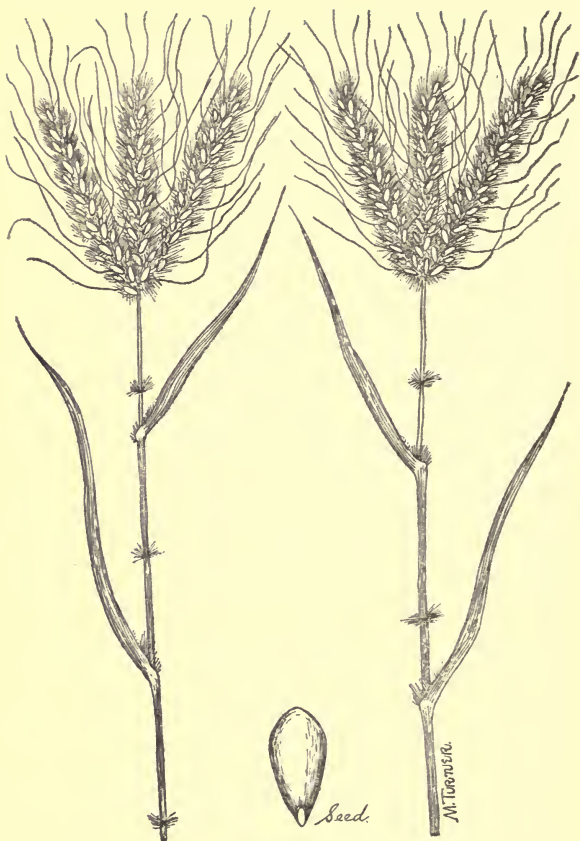
Australlian Rhodes Grass (*Chloris barbata*, var. *decora*) is a robust growing plant attaining a height of from four to five feet or more on good soils. Until quite recently this native grass was only known to occur in the interior of the continent, but in 1903 the author was the first to discover it in the coast districts, and his economic description of it attracted considerable attention from stockowners. Since then it has been found in a number of localities in eastern Australia. In ordinary seasons during the hotter months this grass yields a great bulk of succulent, leafy, nutritious herbage much relished by stock. In its earlier stages of growth it has a creeping habit, and roots from every joint that is in contact with the ground, but the stems soon assume an upright position, and attain the height previously given. Once it becomes established it produces plenty of seed which after a good rainfall germinates readily in early autumn and spring. Splendid hay has been made from experimental growth. Mr. J. C. Brunnich gives the following chemical analysis of the Australian Rhodes Grass :—Moisture, 7.27 ; ash, 9.01 ; fibre, 16.95 ; carbohydrates, 57.98 ; fat and oil, 2.11 ; protein, 7.98 ; total nutriments, 68.07 ; albuminoid ratio, 10.71 per cent.

Bent Grass (*Deyeuxia billardieri*) is usually of annual duration, though in favourable situations it may become perennial. It is widely distributed, being found in the coast districts and on some of the high tablelands in all the States of the Commonwealth, being fairly plentiful in some districts, and quite a feature in the pastures when in seed. In the colder parts it is of short tufted habit, rarely growing more than six inches high, but in more favoured situations it attains a height of eighteen inches, and produces a quantity of leafy herbage. On rich, moist pasture land it grows throughout a greater part of the year, but on dry land it temporarily

disappears at the beginning of summer. It is a capital winter and early spring grass, and sheep are very fond of and do well on its tender and often succulent herbage. When allowed to grow undisturbed it produces a quantity of seed, which usually ripens in October, November and December, according to situation. Although this species and an allied "Bent Grass" (*D. forsteri*) are often closely connected by many intermediate forms they are quite distinct; their economic values being much the same. The latter has a wider range of growth than the former, for it occurs on the inland plains as well as on the coast areas. There are seventeen other distinct "Bent Grasses" indigenous to Australia, and they are widely distributed in all the States of the Commonwealth, but generally in the cooler and colder parts. Although many of them form a good percentage of the herbage in some pastures, and are good feed for sheep, those described are the best known to stockowners.

Black Top (*Pappophorum nigricans*) occurs in all the Australian States from the coast areas to the far interior, and in many pastures grows eighteen inches high or more and forms a good percentage of the herbage. Growing under such varied conditions of soil and climate there are many forms of it. Sometimes the inflorescence is perfectly black, to which circumstance it owes its specific name, and at other times it is almost white. In all its varied forms, however, it is a capital drought-resisting grass, and during the summer months, in an ordinary season, it yields a fair amount of short, leafy good herbage, which stock eat readily and do well on. When the stems of this grass become old they are hard and the leaves harsh, and when in that condition, if other herbage is plentiful, stock seldom eat it. The seeds usually ripen during October, November and December.

Blue Grass (*Andropogon sericeus*) grows from one foot to three feet high and is found all over the continent from the



Blue Grass.

coast to the far interior. Where it is plentiful quite a bluish appearance is imparted to large tracts of country inland, hence its popular name. With the exception of the "Mitchell Grass" it is perhaps the most widely and favourably known of all the grasses in the interior, and pastoralists have formed a high opinion of its value for stock feed. It is essentially a summer grass, and in an ordinary season yields a great amount of leafy herbage, on which all herbivora thrive and fatten readily. If cut when the flowering stems first appear it can be made into excellent hay. Having had this grass under experimental cultivation for some time I can highly recommend it for growing on rich land for permanent pasture, and for making into hay—the latter particularly. My experience and observation of it, which have been considerable, are that on poor, light soils it takes little root hold, consequently it is easily pulled up by the roots when sheep, cattle and horses are browsing upon it. The seeds usually ripen during the summer and early autumn.

In the warmer portions of the continent there is a very fine, robust variety of this species, popularly known as "Tassel Blue Grass," occurring only on rich land, and often growing more than five feet high. It yields a large quantity of palatable herbage which makes excellent feed for cattle and horses. This grass should be a useful one to cultivate for ensilage. An illustration of the Blue Grass accompanies this letter press.

Blue Star Grass (*Chloris ventricosa*) is a fine pasture plant growing from two to three feet high or more, generally occurring on rich soils in the eastern portion of the continent, and fairly plentiful in some districts. During the warmer months it produces a quantity of rich, succulent, leafy herbage much relished by all herbivora. If cut when in flower it makes capital hay. This grass would well repay systematic

cultivation, and as it freely produces seed in summer and autumn, there would be no difficulty in getting the necessary quantity for sowing. There are a few varieties of this grass, but their feeding qualities are much the same as the typical form.

Branching Panic Grass (*Panicum effusum*) is found in all the Australian States from the coast to the far interior, and in some districts very plentifully. There are two distinct forms of this grass; the typical one is hairy, and the other quite smooth. The former occurs mostly in the coast districts and the latter inland. They usually grow from one foot to two feet high, and during the warmer months in ordinary seasons produce a quantity of leafy growth for a considerable time before they develop their flower stems—a decided advantage in a pasture grass. The herbage of both these grasses is much relished by stock, sheep being particularly fond of and thriving on it. The seeds usually ripen during the summer and autumn.

Brown Top (*Pollinia fulva*) is a very superior pasture grass found in all the Australian States and generally on good land both in the coast districts and in the interior, but is much more common in the latter. To many pastoralists it is known as "Sugar Grass" a name given to it on account of the sweetness of its young stems and leaves, but stockmen more generally call it "Brown Top." It sometimes attains a height of four feet, but usually it is not so tall, and may be easily recognised in the pastures by its flowers being covered with rich brown silky hairs, making it conspicuous amongst the surrounding vegetation. During the warmer months, in an ordinary season, it produces a great bulk of sweet, nutritious herbage much relished by all herbivora. Under experimental cultivation it proved a most prolific grass, and the leafy herbage was much superior to that usually seen in the pastures. It made excellent hay when cut just as the flower stems

appeared. From its great yield it should be suitable to grow for ensilage. Its cultivation can be recommended on good land in districts suitable for grazing cattle. When left unmolested for a time it freely produces seed which usually ripens in summer and autumn.

Coast Blue Grass (*Andropogon affinis*) occurs both in the eastern and western portions of the continent, but principally in the coast areas and colder districts. It generally attains a height of from one foot to two feet, according to the class of land it is growing on, the latter on moderately strong, rich loams. It is a valuable pasture grass, and in sheltered situations makes considerable growth during the winter months; therefore it is most useful to the grazier. Throughout an ordinary season it yields a fair amount of rich, leafy, bottom herbage of which all herbivora are fond and on which they fatten, sheep particularly so. This "Blue Grass" makes capital hay if cut when the flower stems first make their appearance. It will stand close feeding, and continue to grow during a long period of dry weather. I have seen this grass growing on lawns, and notwithstanding that they were constantly mown, it was almost irrepressible during the summer and autumn. It is one of the first grasses to start into growth after rain supervening on a long period of dry weather. When left unmolested for a time it freely produces seed which mostly ripens during the summer and autumn.

Cockatoo Grass (*Panicum semialatum*) is an erect growing plant, attaining a height of from two to three feet or more, and generally found on good soils both in the coast and the inland districts in the eastern portion of the continent, but nowhere very abundantly. This grass withstands much dry weather without its growth being seriously checked, and during the warmer months produces a bulk of leafy feed of which stock are fond, and on which they do well. It is an excellent

pasture grass, worth bringing under systematic cultivation, for it does well on various classes of good soil, but on rich land it yields an enormous amount of herbage suitable for turning into hay or ensilage. In autumn its flowering stems become hard and cane like, and the leaves rather harsh, and stock seldom or never touch it in that condition. When allowed to grow undisturbed in late summer it freely produces seed which cockatoos like and eat in great quantities. From this circumstance the popular name is applied to it. The seeds usually ripen in late summer and autumn.

Cockshin or Barn Yard Grass (*Panicum crus-galli*) is of annual duration growing from two to eight feet high, and found generally in the coast districts but occasionally further inland. On rich, moist soils this vigorous-growing grass yields, during the hotter months, an enormous amount of rich, succulent, broad, leafy herbage much relished by cattle, and especially valuable for milch cows. It has been cultivated in a small way as feed for dairy stock, but is well worth more extensively cultivating on fertile, moist land in the coast areas, and I can recommend it for systematic cropping inland where irrigation is possible. If grown under these conditions it would supply an enormous amount of valuable fresh feed for stock, or the crop could be used for ensilage. There would be no difficulty in bringing this grass under systematic cultivation, for under ordinary conditions it produces a great amount of seed in summer and autumn. This grass is common in nearly all the hot and temperate parts of the earth. In America, where it is highly prized, one writer says that "it gives five tons of hay per acre without care or cultivation, and that on the Mississippi hundreds of acres are mowed on single farms." A closely allied native annual grass (*Panicum colonum*) has similar economic properties and can be recommended as auxiliary feed for stock.

Coolah Grass (*Panicum prolutum*) is an erect, rather rigid species occurring over a great part of Australia, but principally in the interior, and in some localities it is fairly plentiful. It grows from one foot to two feet high or more, generally on good land that is liable to periodical inundations, and as it makes most of its growth during the hotter months, and retains its greenness far into autumn, it is a valuable stand-by for stock when much of the surrounding herbage is dry. In the interior it is greatly valued by stockowners as a pasture grass, but is not considered a good one to make into hay, as its stems and leaves are too rigid when fully developed. It makes rapid growth, and the young, leafy herbage is greedily eaten by all herbivora, which thrive on it. Under ordinary conditions the Coolah Grass produces an abundance of seed which ripens during summer and autumn. Before the aborigines tasted the sweets of civilization they collected large quantities of them, and used them as an article of food after grinding them between two stones and converting them into a kind of meal, which they made into dough and cooked like damper.

Coolibar Grass (*Panicum trachyrhachis*) which has stout stems and smooth leaves grows from two to three feet high and is found principally in the eastern portion of the continent, from the coast to the far interior, and in some places fairly plentifully. Inland it is generally found growing on rich soils on open downs, and in ordinary seasons, during the warmer months, yields a great amount of valuable, leafy herbage, of which stock of all descriptions are fond, and on which they fatten. This grass is suitable for systematic cultivation either for permanent pasture or for hay. When allowed to grow undisturbed for a time it produces quantities of seeds which ripen during the summer and autumn. Like the previous species, its seeds at one time formed an article

of food for the aborigines, who used to grind them between stones into a kind of meal, which was mixed with water and made into a kind of dough, and after being baked on a wood fire was eaten and considered nourishing. The blacks also made a kind of twine from the old leaves of this grass. There is a variety of this species of more slender growth, but its qualities are much the same.

Cotton Grass (*Panicum leucophæum*) is found all over Australia from the coast to the far interior ; being much more abundant, however, in the latter than in the former portion of the continent. It is generally found growing on rich soils, and in such situations, in a good season, it often attains a height of three feet. This grass is easily recognised in the pastures when in flower by its spikelets being densely covered with long, silky, silvery or purple hairs, which give it quite an ornamental appearance. It is a valuable pasture grass, and in ordinary seasons yields a quantity of rich, leafy herbage much relished by all kinds of stock. I have had this species under experimental cultivation for several consecutive years, and it proved a very prolific grass. When cut as soon as the flowers appeared, and dried, it made excellent hay, of which horses were fond. When this grass is allowed to grow undisturbed for a time it produces a great amount of seed, which usually ripens in November and December, but occasionally in the autumn. There is a slender growing variety of this species, having a less extended range of growth, but of similar economic value. Both these grasses are worth systematic cultivation.

Couch Grass (*Cynodon dactylon*) occurs in all the States of the Commonwealth from the coast to the far interior, but is much more common in the former portion of the continent. It is of prostrate habit, often creeping and rooting at every joint. When well established on good soils, however, it

grows from one foot to two feet high, if left unmolested for a time. In some districts, in any ordinary season, three crops may be cut if the grass is grown under the close paddocking system, and if they are dried quickly they make splendid hay, which if carefully stacked will keep in excellent condition for several years. Stock are remarkably fond of this hay, and most animals fatten readily on it. Couch grass makes valuable permanent pasture, for it is not much affected by dry weather, close grazing, or frequent trampling by stock. In the coast districts, where frosts are not severe, it is the best native grass for making lawns. It is also valuable for binding loose sand, consolidating earth banks, and protecting river banks from erosion by the fury of flood waters. The seeds of this grass should never be sown nor the roots planted except in places where the grass is to remain permanently, for its underground stems when once they become well established in the soil are most difficult to eradicate; consequently in cultivation this grass is regarded as a pest. Cattle and sheep thrive on its underground stems, which are said to possess some of the medicinal properties of sarsaparilla. Surgeon Thornton says:—"The expressed juice is astringent, and is used as an application to fresh cuts and wounds. It is also diuretic, and is used in cases of dropsy and anasarca, also as an astringent of chronic diarrhoea and dysentery." Surgeon Houston says:—"The juice of the green grass is useful in catarrhal ophthalmia, is astringent, used also with much benefit in hæmaturia." Mueller and Rummel give the following chemical analysis made on the very early spring growth of this grass:—Albumen, 1.60; gluten, 6.45; starch, 4.00; gum, 3.10; sugar, 3.60 per cent.

Early Spring Grass (*Eriochloa punctata*) occurs in all the Australian States from the coast to the far interior, and in many districts it is fairly plentiful. It grows from two to three feet high, and on various classes of good land, and on rich,

strong loams it is a most productive grass. The young growth is of a bluish colour, and when in that condition is often a distinct feature in the pastures. In the warmer and more humid parts of the continent it grows more or less all the year round, but in the interior it is essentially a summer grass. During ordinary seasons it produces a quantity of rich, succulent, leafy herbage of which all herbivora are remarkably fond and on which they fatten. When cut at the right time it makes capital hay. Under ordinary conditions it freely produces seed which usually ripens during November and December in the interior, and a month or two later in the coast areas.

Hooker's Fescue (*Schedonorus hookerianus*) is a stout, smooth-leaved grass growing from two to four feet high or more, and found in the southern portion of the continent, and in Tasmania, but nowhere very plentifully. It is a fine pasture grass, and worth systematic cultivation in the colder districts, including the tablelands, as feed for dairy cattle and the larger herbivora, which are very fond of its leafy herbage, and thrive on it. This grass produces a fair amount of seed which usually ripens in autumn. Since I wrote my first account of the economic value of Hooker's Fescue, under instructions from the Government of New South Wales, there has been a great amount of interest taken in this grass, and it has been experimented with in a small way in several districts with satisfactory results.

Kangaroo Grass (*Anthistiria ciliata*) is one of the grasses most widely distributed on the Australian continent, and in Tasmania, but is more abundant in the coast areas than in the interior. On country that is not heavily stocked it sometimes grows six feet high in good seasons, but generally it does not exceed four feet. In the warmer and more humid parts it grows more or less all the year round, whereas south



Seed

Kangaroo Grass.

of latitude 32 degrees it is essentially a summer grass, for it seldom makes much growth before October and November, but continues developing a quantity of leafy herbage throughout the hotter months. Soon after the flower stems have developed the leaves turn slightly brown and then the nutritive qualities of the Kangaroo Grass are considered at their highest. All herbivora are fond of and do well on it, and horses and bullocks when allowed to graze in pastures where this grass is growing plentifully can be worked very hard and still keep in good condition—a practical proof of its value for stock feeding purposes. This grass, however, will not stand close grazing, and in paddocks that are heavily stocked all the year round, it gradually becomes scarce. It has wonderful recuperative powers, however, and in fenced-off areas it is one of the first indigenous grasses to start into growth after good rains, following on a long period of dry weather. There are two or three forms of this grass, but their qualities are much the same from a stockowner's point of view. Although the Kangaroo Grass develops a number of flowering stems, and to the casual observer would appear to mature a quantity of seed, unfortunately this is far from being the case. The most remarkable circumstance is that some plants produce a little seed whilst others are completely sterile, the latter very greatly predominating. Mueller and Rummel give the following chemical analysis of this grass during its spring growth :—Albumen, 2.05 ; gluten, 4.67 ; starch, 0.69 ; gum, 1.67 ; sugar 3.06 per cent.

An illustration of the Kangaroo Grass accompanies this letterpress.

Landsborough Grass (*Anthistiria membranacea*), also popularly known as Barcoo Grass, Flinders Grass, and Red Gulf Grass, occurs on rich land over much of the interior, including Central Australia, and is fairly plentiful in many

parts of the continent. It is of annual duration, and its seeds germinate readily after spring and summer rains, and the resulting grass grows throughout the hottest period of the year. It is generally seen growing in small tufts, but in favourable seasons the weak stems lengthen very much, and form an entangled mass of herbage, often two feet deep. The Landsborough Grass assumes a reddish tint—hence one of its popular names—and gives a singular appearance to immense tracts of country. It is a most nutritious grass and stock are so fond of it, that when in autumn it often becomes so exceedingly dry and brittle as to break into innumerable pieces they lick up the broken stems and leaves from the ground. I had this grass under experimental cultivation for some time, and raised an excellent crop of herbage in less than three months from the time of sowing the seed. When cut just as the flowering stems appeared it made excellent hay, of which horses were very fond. It is worth extensive cultivation in the arid interior, either for temporary pasture, or to be cut at the right time and made into hay. There would be no difficulty in bringing this grass under systematic cultivation, for under ordinary circumstances it produces an abundance of seed which usually ripens during the summer and early autumn.

Love Grass (*Eragrostis leptostachya*) is a slender species growing from one and a half to two feet high, and occurring in the eastern portion of the continent, including some of the tablelands, but not very far inland. In some districts it is fairly plentiful, and on good land produces rich, succulent herbage much relished by all pasture animals. In the dairying districts it forms a good percentage of the herbage in some of the pastures, and dairy stock do well on it. In favourable seasons it grows nearly all the year round, and if cut at the right time it makes very good hay. When the Honourable Dr. James Norton, LL.D., M.L.C., asked me to botanically

name and describe this grass for him he wrote to me from the Blue Mountains, New South Wales, giving his experience of it in the following terms :—"After an experience of upwards of ten years at 'Euchora,' Springwood, I feel justified in stating that the above-named grass is one of the most valuable of all the Australian grasses. Mixed with other native grasses, it grows freely on my land, and is greedily devoured by the cattle in preference to all other kinds. The milk produced by the cows which feed on these grasses is particularly rich and makes excellent butter. The growth in places protected from the cattle is so great as to supply me in ordinary seasons with an abundance of hay for the winter, and both cows and horses seem almost more fond of this than of the grass in its green state." The seeds usually ripen in summer and autumn.

Meadow Rice Grass (*Microloëna stipoides*) is found in all the States of the Commonwealth from the coast to a considerable distance inland, but is much more plentiful in the former. It has a strong root system which enables the grass to withstand a long period of dry weather without its growth being checked to any serious extent. Although occurring on various classes of country, it yields the greatest bulk of herbage in rich, meadow land, where it often forms a large percentage of the herbage. Under favourable conditions it sometimes attains a height of three feet, but generally it grows from one foot to two feet high, and may easily be recognised by its vivid green leaves, which it retains throughout the year in ordinary seasons. It is a superior pasture grass, its rich herbage being greatly relished by all herbivora, and even under close grazing it will maintain a dense turf. If cut when in flower it makes excellent hay. The seeds, which are freely produced, usually ripen during the summer and autumn.

I have inspected pastures where the ordinary rye grass (*Lolium perenne*) had been sown for permanent grazing and

found that after a year or two it had died out, and that the Meadow Rice Grass formed the larger percentage of the herbage. Mueller and Rummel give the following chemical analysis made on the spring growth of this grass :—Albumen, 1.66 ; gluten, 9.13 ; starch, 1.64 ; gum, 3.25 ; sugar, 5.05 per cent.

Mitchell Grass is the popular name given to three species and one or two varieties of *Astrebla*, one of the most common, *A. pectinata*, being depicted in the accompanying illustration. These famous grasses are found on the fertile plains over a greater part of the interior of the continent, even extending to Central Australia, and are a most valuable stand-by for stock during adverse seasons, for their thick wiry roots penetrate the earth to a great depth, and enable them to withstand a phenomenal amount of dry weather. Many pastoralists and stockmen regard the “Mitchell Grasses” as the best of all the indigenous grasses in the interior, both for drought-enduring qualities, and for their fattening properties. All of them have a branching habit, and under ordinary conditions produce a great amount of nutritious, leafy herbage which is readily eaten by all herbivora. When these grasses become so dry during adverse seasons that their stems and leaves break to pieces, stock may often be seen licking them off the ground, and they seem to do well on this feed notwithstanding its uninviting appearance. Experienced drovers assert that stock travel further and keep in better condition when fed on these grasses than on any other in Australia—a practical proof of their high feeding value. The seeds of these grasses, when ripe, are like small grains of wheat and at one time formed an important part of the food of the aborigines. One of the varieties (*lappacea*) of the Mitchell Grass produces ears which are often more than six inches long, somewhat like big wheat ears, and the comparatively large



Seed.

Mitchell Grass.

grains separate easily from the chaff, like grains of wheat. Where wheat would not grow owing to the great heat and dryness, that variety might, after a few years of thorough cultivation and careful selection, be found an excellent substitute, for, according to the best authorities, the wheat plant developed from much less promising material. The seeds of the Mitchell Grass ripen during the summer.

Mulga Grass (*Danthonia bipartita*) occurs in the interior of the continent and generally on good land, but nowhere very abundantly. Its stems rise from an almost bulbous, often woolly, base which probably acts as a storage reservoir for the plant, for it withstands a protracted drought in what is often termed the desert interior. It usually grows from one foot to two feet high, though occasionally it is taller, and its green leaves may often be noticed amongst the surrounding dried up vegetation, a proof of its drought enduring properties. Stock of all kinds are fond of the Mulga Grass, and thrive on its nutritious, leafy herbage. When allowed to grow undisturbed for a time this grass freely produces seed which ripens during the hotter months. The singular shape of the seed has been commented upon, for it resembles the base of a horse's hoof, on an infinitely smaller scale of course. The seeds form an important item in the food supply of certain birds of the parrot tribe. Mulga Grass is a popular name applied to several other species, principally on account of their association with an *Acacia* known to stockmen as Mulga, but the one under notice is most widely known to pastoralists.

Satin Top (*Andropogon erianthoides*) attains sometimes a height of five feet, but generally only two or three feet. It is peculiar to the interior in the eastern portion of the continent nowhere very abundant, and may easily be recognised in the pastures when in flower by its densely silky-hairy spikes. The Satin Top withstands a phenomenal amount of dry

weather, but this may be accounted for by its strong roots penetrating deeply into the earth. It is a superior pasture grass of which stock of all kinds are remarkably fond and on which they fatten. When there is a scarcity of feed in the pastures, sheep will often eat it so closely to the ground that it has little chance of recuperating as rapidly after rainfall as some other grasses. I have had the Satin Top under experimental cultivation, and in a short time it yielded a large quantity of rich, succulent, leafy herbage which horses ate with avidity. When cut in flower it made excellent hay. This grass is well worth systematic conservation and cultivation. When left unmolested for a time it produces a great amount of seed which ripens during the summer and early autumn. There are fifteen species and several varieties of *Andropogon* indigenous to Australia, and they are widely distributed over the continent, most of them being excellent pasture grasses.

Silver Top (*Danthonia pallida*) grows from two to three feet high and is found in all the States of the Commonwealth from the coast to the interior, but not to the centre of the continent. During the summer months the beautiful silvery white flowers of this grass are often a conspicuous feature in the pastures. It is generally found growing on fertile soils, and in such situations yields, during the summer months, a great amount of rich, leafy herbage much relished by all herbivora, sheep being particularly fond of it and thriving on it. If cut at the flowering period it makes excellent hay which keeps in fine condition for a considerable time if stored under good conditions. The Silver Top is well worth systematic cultivation either for permanent pasture or for growing as a hay crop. When allowed to remain undisturbed for a time this grass produces an abundance of seed which ripens during the summer and autumn. The seeds germinate readily after the spring and early autumn rains, and in consequence it is

fairly plentiful in many localities. It withstands close grazing much better than many grasses, and on this account is a valuable addition to the pastures.

Star Grass (*Chloris truncata*) is found growing on rich land over a great part of Australia, from the coast to the far interior, and is abundant in many localities. As might be supposed, a grass growing under such extreme climatic conditions is variable as regards its height and the amount of herbage it produces. In some situations it grows three feet high, with the flower spikes a foot in diameter; in other localities it grows only from six inches to a foot high, with the flower spikes only four inches across. In all its varied forms, however, it yields rich feed, which is much relished by all herbivora, sheep being particularly fond of it and fattening on it. On loose soils this grass tillers well, and often forms a dense turf. I have had the Star Grass under experimental cultivation for several consecutive years, and the quantity of herbage it yielded was remarkable. When cut just at the flowering period it made excellent hay. This grass can be recommended for permanent pasture and for hay. The seeds usually ripen in summer, but occasionally in autumn. I have sown the seeds of this grass in spring with excellent results, but generally I prefer sowing them in early autumn, for then the resulting seedlings become well established in the ground before the cool season sets in, and are better able to withstand the succeeding summer should it happen to be a dry one.

Tall Oat Grass (*Anthistiria avenacea*) occurs all over Australia, but is more abundant in the interior than in the coast areas. It grows on the richest of soils, and inland generally on plain-country, where it attains a height of five or six feet, but in a good season it may sometimes be seen nine feet high. It has a swollen, woolly base, and strong, long fibrous roots which penetrate deeply into the earth thus

enabling the plant to withstand a phenomenal amount of dry weather without its growth being seriously interfered with. This grass mostly grows in tussocks and at the base produces a quantity of rich, leafy herbage which, when young, cattle are remarkably fond of and fatten on. If cut while the flowering stems and leaves are green and tender it makes capital hay. The Tall Oat Grass is well worth systematic conservation and even cultivation in those districts where it may have become scarce from over stocking. When allowed to grow undisturbed for a time it produces an abundance of seeds, which resemble oats in appearance and size, and as they separate easily from the chaff, I have felt justified in classing it amongst those Australian grasses which I have already suggested might be cultivated for the grain they yield. In the interior the seeds usually ripen in summer, and on the coast early in autumn.

Tall Plain-Grass (*Stipa aristiglumis*) is generally found on rich soils in the eastern portion of the continent, from the coast to the far interior, but is much more plentiful in the latter than in the former. Inland it generally grows on the plains, and attains a height of from two to three feet, but occasionally it is much taller. After the spring and summer rains it grows very rapidly, and its rich, young, leafy herbage is much liked by cattle, horses and sheep, which thrive on it. Many experienced pastoralists regard the Tall Plain-Grass, especially when young as very fattening feed for stock. When this grass becomes old, however, it is often coarse and rather harsh, and then, unless other pasture herbage is scarce, stock seldom eat it. Some years ago the Honourable G. H. Cox, M.L.C., brought me a specimen of this grass found on his station on the Liverpool Plains. It was nine feet six inches tall, and it was so abundant that the cattle grazing amongst it were completely hidden from view. This grass, when allowed to

grow undisturbed for a time, produces an abundance of seed which ripens in summer and autumn.

Umbrella Grass (*Chloris acicularis*) is found in all the Australian States, but principally in the interior, and generally on sandy or light loamy soils, though I have occasionally seen it growing equally well on much stronger land. This grass has a strong root system, which enables it to withstand much dry weather and remain green throughout ordinary seasons. Generally it grows from one foot to two feet high, and yields a great amount of rich herbage which herbivora of all kinds are fond of and fatten on, sheep particularly. The Umbrella Grass produces an abundance of seed which usually ripens during the summer and autumn.

There are ten species and a few varieties of *Chloris* indigenous to Australia, and they are widely distributed over the hotter parts of the continent from the coast to the far interior, and fairly abundant in many districts. Most of them are excellent pasture grasses.

Wallaby Grass (*Danthonia semiannularis*) occurs over nearly the whole of Australia from the Coast to the far interior, including some of the mountain ranges where snow falls occasionally. No other grass in Australia grows under more varied conditions of soil and climate than the Wallaby Grass. In the coldest districts it grows only six inches high, but under more favourable climatic conditions it attains a height of three feet or more. Although it is not particular as to soil and situation, for it may as frequently be seen growing on dry ridges as on the better classes of soil, still it produces a larger quantity of superior herbage on moderately strong, rich, deep land. It is one of the most valuable Australian grasses, and, unlike most of its congeners, grows more or less all the year round. All kinds of stock are remarkably fond of it, sheep particularly



Wallaby Grass.

so, and thrive on its rich herbage. When allowed to grow undisturbed for a time it produces an abundance of seed which germinates readily after spring and autumn rains. I have had this grass under experimental cultivation for a considerable time, and the leafy herbage it then produced was much superior, both in quality and bulk, to that generally seen in the pastures. When cut at the early flowering stage it makes excellent hay, which will keep in good condition for a long time if properly stored. The Wallaby Grass can be highly recommended for systematic cultivation, either for permanent pasture or for hay. Inland the seeds of this grass usually ripen in October, but in the coast and colder districts it is generally from one month to two months later, though occasionally in autumn. An illustration of the Wallaby Grass accompanies this letterpress.

There are eleven species and several varieties of *Danthonia* indigenous to Australia, most of them being widely distributed over the continent, and all fine forage grasses. The tallest and most remarkable species is *D. robusta*, popularly called "Ribbon Grass," which occurs on the southern mountains, where it forms large tussocks of coarse but nutritious herbage. It usually grows from four to five feet high, but occasionally it is taller, and affords shelter for many of the dwarf "Bent Grasses," and other sub-alpine flora.

Warrego Grass (*Panicum flavidum*) is found generally in the eastern division of the continent from the coast to the far interior, but is much more widely distributed, and more abundant in the latter than the former. It usually grows from one foot to nearly three feet high, but occasionally it is taller. Inland it generally grows on deep, rich soils, and in such situations will often remain green during a long period of dry weather. In ordinary seasons it produces a great bulk of rich, leafy herbage, of which stock of all kinds are remarkably



seed

Warrego Grass.

fond and on which they fatten. Pastoralists very justly hold this grass in much esteem, and many consider it is one of the best that grows in the interior. It is well worth systematic conservation and even cultivation on the dry inlands, and can be recommended for permanent pasture, or for hay. There would be no difficulty in bringing this fine grass under systematic cultivation, for in an ordinary season it produces an abundance of seed which germinates readily after the spring and early autumn rains. The seeds are comparatively large, and are often so numerous that the stems lie prostrate on the ground from their weight. The plain-turkey is very fond of the seeds of this grass. There are one or two varieties of the Warrego Grass, but their pastoral and stock-feeding value is much the same as that of the typical one. An illustration of the Warrego Grass accompanies this letter-press. The seeds were formerly an article of food for the aborigines.

There are fifty-six known indigenous species, and several varieties, of *Panicum*, widely distributed over the continent, and many of them form a good percentage of the pasture herbage, most of them being valuable grasses. Many of them withstand a phenomenal amount of dry weather, and are amongst the first to develop new growth after rain supervening on drought.

Water Couch (*Paspalum distichum*) is a creeping, rapid-growing, summer grass occurring mostly in the coast districts, and sometimes close to the ocean, in most of the Australian States. It is generally found on moist land, in swampy places, and sometimes in shallow water. It is particularly well adapted for covering waste, moist lands, and the margins of rivers and dams, which it binds firmly once its underground stems become well established. Periodical inundations will not destroy it, but severe frosts injure it. This grass yields a quantity of valuable herbage, of which stock of

all descriptions are remarkably fond and on which they thrive. Experienced dairymen speak highly of this grass as feed for cattle. It cannot be recommended, however, for making into hay, as it turns black in drying. Generally it remains beautifully green throughout the summer, and some persons have been tempted to plant it on lawns, with rather serious consequences, however, for to keep it in anything like order during the summer months it requires to be mown two or three times a week, and it is as hard to eradicate from cultivated land as ordinary couch grass. Water Couch produces an abundance of seed which ripens during January, February and March. Mueller and Rummel give the following chemical analysis of this grass made during spring of the year :—Albumen, 2.20 ; gluten, 7.71 ; starch, 1.56 ; gum, 1.64 ; sugar, 5.00 per cent.

Weeping Love Grass (*Eragrostis pilosa*) is of annual duration and found in all the Australian States from the coast to the far interior, but more abundantly in the latter than the former. It generally grows from one foot to two feet high, but occasionally I have seen it three feet. It usually starts into growth about the end of September, and in an ordinary season will continue growing till March or April. If the season should be a very dry one this grass may temporarily disappear by the end of December, but will spring up again from the ripened seed if rain should fall in January or a little later, and then yield a fair amount of herbage during the late summer and autumn. It is not particular as to soil or situation, for it may frequently be seen growing both on stony ridges and on rich meadow land. On good soils it is a most prolific grass and during the warmer part of the year affords a large amount of rich, leafy herbage, much sought after by stock of all kinds. On poor soils it takes very little root hold, and when being browsed on is easily pulled up by the roots.

I have had this grass under experimental cultivation, and it gave a heavy yield in a short time, and on being cut, when the flowers first appeared, it made very good hay. This Love Grass produces an abundance of seed which ripens during the summer and autumn. There are twenty-one species and several varieties of *Eragrostis* recorded for Australia and they are widely distributed; quite a number occurring in the centre of the continent. Most of these grasses are good pasture feed, and very remarkable for their drought-enduring properties. Several of the interior ones have large, bulbous bases from which a quantity of leafy herbage develops after rainfall, no matter how long the previous dry weather has been.

Wheat Grass (*Agropyrum scabrum*) occurs in all the States of the Commonwealth, and is fairly common in many districts from the coast to the far interior. It is a very variable grass as regards its height, and the bulk of herbage it yields. On poor soils it rarely exceeds one foot in height, and has slender foliage; on rich land it grows from three to four feet high or more, and has wider and longer leaves, generally having a bluish tinge. In the more favoured parts it makes considerable growth during the winter and early spring, before many of the other indigenous grasses begin to grow, and stock of all kinds are fond of the herbage whilst it is young. When old, however, the stems and leaves are rather harsh, and stock seldom eat it in that state if other good feed is plentiful. If cut when the flowers first appear it makes good hay. I have had this grass under experimental cultivation, and the herbage was superior to that ordinarily seen in the pastures both in bulk and quantity. The seeds usually ripen during September, October and November. There is a variety of this grass with shorter seed awns, but with this exception its qualities are much the same as the type.

Wild Sorghum (*Sorghum plumosum*) grows over large tracts of country in the eastern portion of the continent, including the tablelands, but not very far into the interior. In the warmer parts it attains a height of from four to five feet or more, but in the colder districts it rarely grows so tall. In the former it grows more or less all the year round, and during an ordinary season it yields a great bulk of valuable leafy herbage, which the larger herbivora eat with avidity, and on which they thrive. Horses are very fond of the ripe seeds of this grass and skilfully strip them off the stems between their teeth. This species grows too vigorously in the warmer parts to be classed as sheep feed, although in the colder districts, where it is essentially a summer grass and does not grow so strong, sheep eat it readily enough and thrive on it. When allowed to grow undisturbed for a time the Wild Sorghum freely produces seed which ripens during the summer and autumn. After the spring rains the seeds germinate readily, so that there would be no risk in bringing this fine grass under systematic cultivation. Owing to its bulky growth it might be profitable to grow for ensilage. There are four other species of *Sorghum* indigenous to Australia, and they are widely distributed over the warmer parts of the continent. All of them grow tall and yield a great bulk of leafy herbage which is good feed for the larger herbivora. The grasses which have been briefly described are only a small percentage of the valuable ones indigenous to Australia, but they are amongst the most widely distributed and favourably known to experienced pastoralists, and will suffice to illustrate the great economic value of an important part of the pasture herbage of this large southern continent.

PASTURE HERBS.

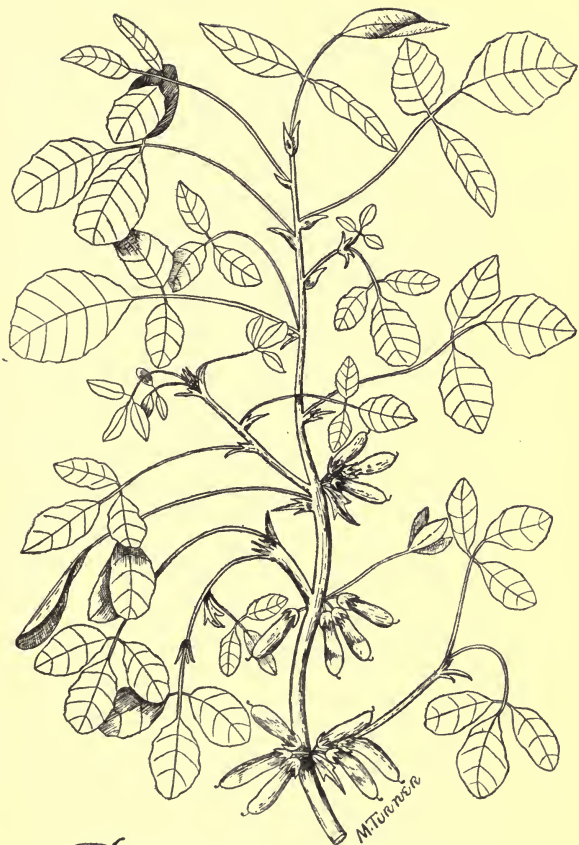
Crowfoot.—Two important pasture herbs from a stockowner's point of view are called Crowfoot, viz., *Erodium cygnorum* and *Geranium dissectum*. The former is an annual or biennial plant, with stems usually laying flat upon the ground, and three feet or more long. It has large deeply-lobed leaves and blue flowers, and when in bloom is a conspicuous object amongst the surrounding vegetation. In spring and early summer it often forms sixty per cent. of the herbage on some areas. This plant is widely distributed over Australia, and is found as frequently on sandy as on more fertile country. It is a superior pasture herb, and whilst young affords rich, succulent herbage, of which herbivora of all descriptions are remarkably fond, and on which they do well. Horses will often leave good feed to browse upon it. All stockowners speak very highly of this herb, and regard it in a young state as an excellent forage plant. Under cultivation it produces a large amount of herbage, and if cut when in flower it makes not only valuable auxiliary green feed, but, when properly cured, capital hay. This Crowfoot when in fruit is disliked by the sheep-owner, on account of its sharp-pointed seed lobes, which not only attach themselves firmly to the wool, but sometimes penetrate the skin of the animals.

The latter (*Geranium dissectum*) is a spreading plant, with a thick, carrot-like root, deeply-divided leaves, and usually pink flowers. It is found in all the States of the Commonwealth from the coast to the far interior, and in some districts fairly abundantly; its root system enabling the plant to withstand a long period of dry weather without its growth being seriously checked. In drought time the roots remain dormant, but after a good fall of rain put forth stems and leaves in abundance. Stock of all kinds are partial to this

plant, which is considered nutritious. Sheep are very fond of the carrot-like roots, and often scrape away the earth with their hoofs in order to get at them. At one time the roots formed an article of food for the aborigines, who used to roast them on ashes before eating them. The seed lobes of this plant have no sharp points like those of the one previously referred to.

Darling Clover (*Trigonella suavisissima*), an illustration of which accompanies this letterpress, is a clover-like plant with fragrant stems and leaves, and occurs in more or less abundance over an immense area in the interior. In favourable situations it produces stems three feet long or more. When growing on land that is subject to periodical inundations, it produces a large amount of nutritious herbage, of which stock are particularly fond, and on which they fatten. Though this plant gives the greatest yield of herbage on fertile land, it often grows on stony rises and on inferior country, and in such situations it is a valuable addition to the pastures, as it provides good feed in late winter and early spring ere many other useful forage herbs begin to put forth much new growth. The perfume of this plant is due to the presence of the chemical principle coumarine which prevades all parts of the plant. The Darling Clover is one of the many indigenous herbs that would well repay systematic cultivation in the interior, where exotic clovers would not succeed, owing to the aridity and great heat in summer. If cut when in flower, and properly cured, it makes good hay. Its young succulent stems and leaves are an excellent table vegetable when properly cooked and served. When allowed to grow undisturbed for a time the Darling Clover freely produces seed which usually ripens during summer.

Mustard.—Many cruciferous plants are popularly known by the name of mustard, with various prefixes, or cress, on account of the pungent flavour that pervades most of them.



Darling clover.

They are widely and abundantly distributed over the continent. Most of them average about one foot in height, and are good forage plants, which most kinds of stock eat with avidity, their more or less pungent flavour contributing to their palatability. Dairy cows giving milk, however, should not be allowed to graze in pastures where these plants grow abundantly, for when eaten freely they flavour both milk and butter. All these plants when not too closely fed over, produce an abundance of seed, which germinates readily after a good rainfall at almost any season of the year, and the resulting young growth is a quantity of succulent herbage.

Nardoo (*Marsilea drummondii*) is a plant of historical interest, inasmuch as its fruit at one time formed, after preparation, an important article of food for the aborigines, and is still used by them in the far interior, and the unfortunate explorers Burke and Wills tried to subsist on it, although judging from Wills' journal, it does not appear to have afforded them much nourishment. This dwarf, clover-like plant, occurs in the interior of all the Australian States, generally on the margins of swamps, or where water collects in shallow pools after rain. When the water subsides the young plants grow rapidly in the mud, and eventually cover the ground with dense vegetation, reminding one of cultivated clover. Stock of all kinds are extremely fond of this plant, which is regarded as nutritious feed.

Native Carrot is the popular name of an annual herb (*Daucus brachiatus*) with herbaceous stems, often growing from two to three feet high, but generally not so tall. It has elegant, divided leaves, small flowers arranged in clusters, and burr-like fruits, which are when ripe called "carrot burrs" by stockmen. This plant is widely distributed over the interior of Australia, growing on both rich and sandy country, and in spring and early summer forms a large percentage of the herbage on extensive areas. In a young state the native

carrot is an exceedingly good forage plant, to which most kinds of pasture animals are partial, particularly sheep, which thrive on it. This herb improves much under cultivation, and yields a larger bulk of herbage than is usually seen under the best natural conditions. It produces an abundance of seed, which germinates readily after rain, and to these circumstances may be attributed its extensive growth in the interior. Carrot burrs, covered with hooked bristles, are much disliked by the sheep owner, because they adhere to the fleece with great tenacity, and therefore, are troublesome to get out of the wool.

Native Lucerne (*Psoralea tenax*) is a member of the pea flowering family, with slender branching stems, growing from one foot to two feet high or more, divided leaves and small, usually blue, flowers disposed on long stems. It has long, very strong roots, which penetrate the earth from five to seven feet or more, and thus enable the plant to endure a phenomenal amount of dry weather without its growth being checked to any serious extent. The Native Lucerne is widely distributed over the eastern portion of the continent, and many pastoralists regard it as an excellent forage plant. Most herbivora are fond of its young succulent stems and leaves, and seem to do well on them. A very closely allied leguminous plant (*Lotus corniculatus*), widely distributed on the Australian continent and in Tasmania, has long been regarded by experienced stockmen as a valuable forage plant. There are other pea flowering herbs belonging to different genera and occurring in more or less abundance in many parts of Australia, that are very good forage plants, and are largely eaten by all herbivora.

Native Plantain (*Plantago varia*) has a long tap root and leaves varying from less than six inches to one foot long. It is found over a great part of Australia, and on immense areas in the interior it is fairly abundant. This plant grows on both

rich and inferior country, but on the former yields a much larger amount of herbage. Its succulent, mucilaginous leaves are much relished by sheep, and dairy cows fed on the plant are said to yield plenty of milk. Horses, however, eat the plant but sparingly. When not too closely fed over, this plant produces an abundance of seed upon which certain kinds of birds feed. Its seeds are sometimes gathered by the settlers in the back country, who use them as a substitute for commercial sago, hence one of its popular names, "wild sago." There are six species and several varieties of the genus *Plantago* indigenous to Australia, three of them occurring in the coldest parts, with much the same properties as the one described above.

Parakeelya is the aboriginal name of a plant widely distributed in the drier and hotter parts of the continent, and known to scientists as *Calandrinia balonensis*. This is an erect growing plant of from six inches to one foot high, or more, the slender branching stems of which are clothed with thick, fleshy leaves one inch to two inches long. Its rather large purple flowers are disposed on terminal stalks. When figuring and describing, under instructions from the Government of West Australia, the plants of economic value that compose the pasture herbage of the western portion of the continent, my attention was drawn to this plant with very succulent leaves as being one of the best to assuage the thirst of stock that eat it. It is now well known that Parakeelya affords both feed and moisture to herbivora in waterless country, and there are authentic records of stock having travelled nearly three hundred miles without a drink of water over country where this plant was growing. Some allied indigenous species have similar properties. The *purslane* or *munyeroo* of the aborigines (*Portulaca oleracea*), is an annual belonging to the same family as the parakeelya, with succulent stems and leaves which are much relished by most pasture

animals, and which in the interior often afford them both feed and moisture. Its stems and leaves are gathered, cooked and eaten both by the white settlers and by the blacks. When allowed to grow undisturbed for a time this plant produces quantities of small, black seeds, which are collected, cooked and used as an article of food by the aborigines in the interior.

Tarvine (*Boerhaavia diffusa*) has spreading stems, growing sometimes several feet long, and often forming a dense mass of herbage. It occurs over large tracts of both good and inferior country in the interior, and occasionally near the coast, in all the Australian States, and in many districts is fairly plentiful. Its rather thick, fleshy, long roots, which at one time formed an article of food for the aborigines, are said to have vermifuge properties. The Tarvine withstands a long period of dry weather, and its green leaves, and small, pink flowers may often be seen when the surrounding vegetation is withered for the want of rain. It is a good forage plant, and both cattle and sheep are partial to it. As it begins to grow in early spring, before many other useful kinds of herbage put forth new leaves, it is a desirable plant to encourage in the pastures. The plant may frequently be seen growing in juxtaposition to members of the mallow family, particularly species of *Lavatera*, *Malvastrum*, and *Si'a*, several of which whilst young are good forage plants. In that state sheep and cattle are very fond of them, for both their stems and leaves are succulent and mucilaginous. An illustration of the Tarvine accompanies this letterpress.

Warrigal Cabbage (*Tetragonia expansa*) is a prostrate-growing annual, with stems, which sometimes extend several feet, clothed with succulent leaves from two to four inches long. It is widely distributed in all the States of the Commonwealth, from the coast to far inland, and occurs on both good and inferior country. Warrigal Cabbage is both an excellent table vegetable, when properly cooked and served, and a very



Fruit

Jarvine.

good forage plant. Sheep and cattle are particularly fond of its succulent stems and leaves, which not only provide good feed, but assuage the thirst of the animals that eat them—a great consideration in dry seasons in the interior. When growing on good country it produces in a short time a great amount of herbage, and on that account is well worth systematic conservation and even cultivation. Under ordinary conditions this plant freely produces seed which ripens during the summer and autumn.

The above brief descriptions of some of the most prominent pasture herbs indigenous to Australia will give an excellent idea of the great importance of these plants in the pastures, and the necessity of systematically conserving them in order to keep the grazing areas in a suitable condition for feeding stock.

SALT-BUSHES.

Old-Man Salt-Bush (*Atriplex nummularia*) is one of the tallest and best known members of this family. It occurs over a greater part of the interior of Australia, but it is not nearly as plentiful as formerly, and is becoming scarce in those districts that are carrying much stock, for most herbivora, except horses, eat it readily, and do well on it, when it is partaken of in conjunction with other herbage. In a natural state it usually grows from six to ten feet high; but occasionally I have seen it attain a height of fifteen feet or more under cultivation. It has numerous spreading branches, which are clothed with fairly large, thick, succulent, almost



Old Man Salt-Bush.

circular leaves of a whitish colour, which gives the plant a singular appearance, and often makes it a prominent feature on the inland plains. The pollen-yielding flowers and the seed-bearing ones are mostly produced on separate plants, but occasionally both kinds of blooms may be seen on the same shrub. When allowed to grow undisturbed for a time the Old Man Salt-Bush produces plenty of seed, so those desirous of collecting it and bringing the plant under systematic cultivation would have no difficulty in obtaining a supply. In winter the ground where it grows may often be seen covered with water, while in summer the earth becomes very hard and dry under the fierce rays of the sun, yet its growth is not checked to any serious extent by these extremes. These facts are only mentioned to illustrate the very hardy nature and drought-enduring qualities of this Salt-Bush. Its young, tender stems and leaves can be boiled and used as a table esculent, and when properly cooked make a very good substitute for the cultivated spinach. As the foliage contains a large percentage of common salt, it should be boiled in plenty of water.

Mr. W. A. Dixon gives the following chemical analysis of the Old Man Salt-Bush :—

Oil	..	..	..	2.18
Carbohydrates	..	..	..	42.85
Albuminoids	..	..	..	16.45
Woody Fibre	..	..	..	7.24
Ash, C.O ₂	..	..	..	31.28
				<hr/>
				100.00
				<hr/>
Nitrogen	..	..	..	2.63
				<hr/>
Woody parts of plant	..	..	..	10 per cent.
Edible parts of plant	..	..	..	90 per cent.

Salt-Bush as a Fire Break.—During my extensive travels in Australia, describing the indigenous and acclimatised vegetation, I have seen several disastrous grass fires in the interior. Where Salt-Bush was fairly abundant the effects of the fires were not nearly as disastrous as where this valuable vegetation was scarce, or had been eaten out by stock. The succulent leaves of the Salt-Bush were only slightly scorched after the fire had passed over the country, and the growth afforded great protection to the more delicate grasses and herbs, which soon begin to grow again if the weather and soil conditions are favourable. It was after making these observations that I advocated the planting of the Old Man Salt-Bush as a fire break, for it is easily cultivated and grows rapidly. A plantation a chain wide or more, and as long as desired, could be formed between two parallel stock-proof fences at comparatively little expense. Such a plantation would answer the double purpose of affording excellent feed for cattle and sheep (the upper growth being judiciously cut for this purpose) and providing a dense growth that would arrest the progress of the fiercest bush fire that menaced homestead and crops. It is not necessary to plough or otherwise work all the land between the fences for the reception of the seeds. All that is required is to pulverise the soil in patches, eighteen inches square, and one foot deep, at intervals of from eight to ten feet, with a strong hand hoe, and thus form a good seed bed, which should be slightly concave on the surface. In the centre of each depression sow half a dozen seeds, preferably in early spring, and leave them covered with about half an inch of fine, light soil. The only attention that is necessary is to keep the weeds and grass in subjection about the young plants, after which they will take care of themselves. Under ordinary conditions Salt-Bush raised in this way will have grown from four to five feet high by autumn. This Australian Salt-Bush is reported to be growing well in India and some of

the warmer parts of Africa. An illustration of the Old Man Salt-Bush accompanies this letterpress. The pollen producing flowers are shown on the larger branch, and the seed bearing ones on the smaller one.

Amongst the most widely and favourably known of the creeping Salt-Bushes is *Atriplex semibaccata*, an illustration of which accompanies this letterpress. It occurs in all the Australian States from the coast to very far inland, but is much more abundant in the latter than the former. This plant consists of many slender, herbaceous stems spreading in a wild state from one foot to two feet or more, but under cultivation its growth is simply astonishing, and a single plant has in one season covered a space sixteen feet in diameter. Its roots penetrate the earth to a great depth, and thus enable the plant to withstand a long period of dry weather without its growth being seriously checked. All experienced stock-owners regard this Salt-Bush as most valuable feed for sheep which thrive and fatten on it. In the report of the American Agricultural Experiment Stations, the following statement about this Salt-Bush occurs :—"This plant (*Atriplex semibaccata*) has proved most valuable in some of the worst alkali spots of California. The yield of a full crop is about twenty tons of green material, or, calculating on the basis of seventy five per cent. of water, five tons of dry matter per acre. A good season would permit of two such crops. It seems to be already demonstrated that this Australian species of *Atriplex* will constitute itself a most important industrial factor in this State, and will render productive vast tracts of land which are at present a blot on the landscape." When allowed to grow undisturbed for a time this Salt-Bush produces quantities of seed which usually ripen during the summer and autumn. There are thirty-one known species of *Atriplex*



Creeping Salt-Bush.

indigenous to Australia, and they are widely distributed over the continent, most of them being excellent forage plants, and remarkable for their drought enduring qualities.

There are twelve native species of *Chenopodium*, found in various parts of the continent, and they are known to stockmen by such popular names as "Blue Bush," "Fat Hen," "Lambs' Quarters," "Nitre Bush," and "Salt-Bush." The "Blue Bush" (*C. auricomum*) is a superior forage plant occurring on the inland plains, where it often grows five feet high or more. Its stems are clothed with almost angular-shaped leaves from one inch to two inches long, and it is easily recognised in the pastures by its almost golden hue—hence its specific name—*auricomum*. Cattle and sheep are particularly fond of it, and stockmen speak very highly of it, both for its nutritive properties and for its wholesome qualities. The succulent stems and leaves of this plant are an excellent table vegetable when cooked and served in a similar way to spinach. Lambs' Quarters (*C. atriplicinum*) rarely grows more than one foot high, but it branches freely from its thick base, and often forms a dense mass of nutritious, succulent, leafy herbage, much relished by all herbivora. Its tap-like root penetrates deeply into the earth, and in consequence the plant is often green when the surrounding herbage is brown. The Nitre Bush (*C. nitrariacea*) is a branching under-shrub of from three to four feet in height, though under cultivation it grows eight feet high and six feet in diameter. It is fairly common on some of the inland plains, and sheep eating this bush often trim it as neatly as if it had been clipped with hand shears. It withstands a lot of dry weather, and no matter how closely it is cropped soon puts forth new growth.

Those Salt-Bushes popularly known as "Cotton Bush" and "Grey Bush" belong to the genus *Kochia*, of which there are fifteen known species indigenous to Australia. They are of shrubby habit and widely distributed over the interior of the continent. All of them withstand a phenomenal amount of dry weather, and their growth does not seem to be checked to any serious extent by the hot winds that periodically blow over the inland plains. One of the best and most favourably known to stockowners is the Cotton Bush (*Kochia aphylla*) so-called from the woolly-like galls which form on the plant during periods of prolonged dry weather, and which are generally supposed to be caused by some insect. This plant, which grows from two to three feet high, occupies large tracts of country in the interior, and its presence is nearly always an indication of good grazing land. Stock of all kinds are remarkably fond of this Salt-Bush, on which they thrive and fatten. In dry seasons on some stations quantities of it are cut and chaffed before being fed to stock. The chaffed material, after being cut for a few days, has a perfume like new mown hay. Sometimes Cotton Bush is chaffed with "Mulga" (*Acacia aneura*) and "Belar" (*Casuarina glauca*), and horses and bullocks are said not only to work well on this feed, but to fatten on it. The Grey Bush (*K. pyramidata*) is a many-branched shrub, growing three feet high or more. The whole plant is covered with dense, soft hairs of a greyish colour, hence stockmen call it "Grey Bush." It occurs over an immense area in the interior, and is quite a feature on some of the plains. This Salt-Bush generally grows on good land, and it is probably on that account that it thrives during prolonged dry weather. Sheep are particularly fond of this plant, and the following analysis shows that it possesses good feeding value. Mr. W. A. Dixon gives the following analysis of the "Grey Bush":—

Oil	..	..	..	2.14
Carbohydrates	..	..	..	32.63
Albuminoides	..	..	..	19.94
Woody Fibre	..	..	..	8.04
Ash, CO ₂	..	..	..	37.25
				<hr/>
				100.00
				<hr/>
Nitrogen	..	..	..	3.19
				<hr/>
Woody parts of plant			..	37 per cent.
Edible parts of plant	..		..	63 per cent.

The Berry-Bearing Salt-Bushes are endemic in Australia and consist of twelve species of *Rhagodia*. They are found in all the States of the Commonwealth from the Coast to the far interior. Most of them are excellent forage plants, cattle and sheep being particularly fond of them. The tallest, *R. parabolica*, attains sometimes a height of fifteen feet, but generally it is not so tall. It is sometimes called Old Man Salt-Bush, a name by which another tall-growing species, previously referred to is now more generally known, and occurs in the interior, where it occasionally forms a prominent feature on some of the plains, but it is not nearly as plentiful as formerly. This is one of the Salt-Bushes of which grasshoppers are so fond that they sometimes denude it of its foliage, leaving only the bare stems, which, however, when left undisturbed, soon put forth new leaves. An allied shrubby species (*R. hastata*) grows from two to three feet high in a natural state, but attains a height of five or six feet under cultivation. In the interior, sheep, when eating the succulent stems and leaves of this plant, often trim it as neatly as if it had been clipped into shape by hand shears. Two of the dwarfest species of this genus are the Flax-Leaved Salt-Bush

(*R. linifolia*), and the Nodding Salt-Bush (*R. nutans*), and they occur both in the coast areas and inland. Sheep are particularly fond of and thrive on their slender herbaceous stems and leaves. Although the above are only a fair percentage of the indigenous Salt-Bushes, they are amongst the best and most favourably known to stockowners. From the brief descriptions an excellent idea can be formed of their economic importance and of their great value to the pastoral industry of Australia.

There are very few members of the Salt-Bush family that are not suitable for forage purposes, though exception may be taken to those species whose stems, leaves and fruit are enveloped in a cottony or woolly substance, for sheep have died after eating too freely of this indigestible stuff together with other parts of the plants. The dorsal spines on the fruits of all species of the genus *Anisacantha* occasionally cause some trouble to the salivary glands of sheep and other small herbivora if they eat too much of the plants when the fruits are near maturity. Stock, however, eat most of these Salt-Bushes without any serious consequences, when the stems and leaves are young and tender. *Anisacantha muricata*, when dry, makes the troublesome "roley poleys" which the wind occasionally blows over some of the inland plains to the consternation of horses and cattle. Stockmen call the ripe fruits of the various species of *Anisacantha* "bindyhies" and sometimes "Bogan fleas" because they cause irritation of the skin when camping in country where the plants that produce them grow.

EDIBLE SHRUBS.

Berrigan (*Eremophila longifolia*), of which an illustration accompanies this letterpress, occurs in all the Australian States and in some inland localities it is fairly plentiful; but in others it is becoming scarce owing to its having been largely cut down for stock feed. It is a tall shrub, occasionally growing twenty-five feet high, with rather thick, narrow leaves, from three to five inches long, tapering into recurved points. Its drought-enduring properties are remarkable, for it grows under the most adverse conditions of intense heat and aridity. Both cattle and sheep eat the leaves of this shrub with avidity, and seem to thrive on them. The following analysis of the partially dried leaves, by Mr. F. B. Guthrie, show them to be of good feeding value :—

Water	..	..	..	51.59
Ash	..	..	..	3.70
Fibre	..	..	..	5.43
Albuminoids	..	..	..	8.87
Carbohydrates	..	..	..	29.66

The nutrient value is $40\frac{1}{2}$, and the albuminoid ratio $1:3\frac{1}{2}$.

The fresh leaves would show a higher percentage of water and, of course, would be more succulent feed. Rabbits have a *penchant* for the bark of the Berrigan, and have destroyed large numbers of shrubs by eating the bark for a few feet up the stems from the base. Under ordinary conditions the Berrigan produces a quantity of seed, and those who purpose propagating the shrub should sow the seeds where the



Berrigan.

resulting plants are to grow permanently, for the seedlings do not bear transplanting well. Some stockmen call this shrub "emu-bush," but that name is given to many plants whose ripe fruits are eaten by emus. Berrigan is the aboriginal name of the shrub.

Quiramarra (*Eremophila bignoniæfolia*) of the aborigines is an allied graceful shrub or small tree widely distributed in the interior of the continent, though not so plentifully as formerly. Its leaves are from two to six inches long, and are much relished by sheep, cattle and rabbits. *E. oppositifolia* is an ornamental shrub or small tree attaining sometimes a height of twenty feet, and growing over large tracts of country in the arid interior, but in many districts not nearly so plentifully as formerly, as large numbers have been cut down for stock feed. Its leaves are from one inch to two inches long or more, and cattle and sheep are fond of them. Sheep often trim the leaves and smaller branches of *E. maculata* so neatly that they appear to have been clipped into shape with a pair of garden shears. In Australia there are thirty-two distinct species and several varieties of the genus *Eremophila*, including those above referred to, and they occur in more or less abundance in the drier and hotter parts of the continent.

Butter Bush (*Pittosporum phillyræoides*) is a handsome, evergreen shrub, attaining sometimes a height of from fifteen to twenty-five feet. It is often called "Native Willow" on account of its pendulous smaller branchlets, which are clothed with dark-green foliage, giving it a graceful appearance, and making it a striking object amongst other vegetation. Many admirers of the native flora regard the Butter Bush as one of the most beautiful shrubs of the back country. It occurs over a great part of Australia, but principally in the arid interior, where it withstands a phenomenal amount of dry weather without any appreciable check to its growth. Its

rather narrow leaves are from two to five inches long, and of a thick substance, and are much relished by cattle and sheep, which eat quantities of them in dry seasons. Even when quite young it produces a profusion of small, bell-shaped, pale yellow flowers, which are succeeded by nearly oval fruits, containing numerous orange coloured seeds enveloped in a sticky mass. The ripe seeds germinate readily under ordinary conditions, and numbers of seedlings may frequently be seen growing under the parent plant. Growing near the Butter Bush may often be seen various shrubby species of the genus *Cassia*, the foliage of which is more or less eaten by cattle and sheep, the latter being particularly fond of the young seed pods, which are produced in great profusion in some seasons.

Cobar Myrtle (*Myoporum deserti*) sometimes called "Sweet-Berried Myrtle," is a compact-growing shrub, attaining a height of from three to four feet, and widely distributed in the interior of all the Australian States. Both cattle and sheep are fond of its leaves and eat them readily, even when other herbage is plentiful. In some seasons this shrub produces quantities of small, ovoid, yellow (when ripe) fruits of a peculiar but not unpleasant flavour, which are much eaten and relished by the aborigines. The bark is palatable to rabbits, which are responsible for the destruction of large numbers of plants. On considerable areas nothing but their dead, white stems, once surmounted by good stock feed, is to be seen, but on the older ringbarked (by rabbits) areas grass and other herbage is gradually taking possession.

Hop Bush.—Several native shrubs belonging to different families of plants are called Hop Bush, but the most important ones, from a stockowner's point of view, are species of *Dodonaea* and *Daviesia*. The former occur in all the Australian States from the coast to the far interior, and the latter are widely

distributed on the continent, but mostly near the coast. *Dodonæa attenuata* is a shrub attaining a height of eight or ten feet, with narrow, rather thick and rigid leaves, usually from two to four inches long. Its habitat is principally in the interior, and generally it grows on soils of a sandy nature, and is a prominent feature on many sandhills. During adverse seasons this shrub is a valuable stand-by on some stations, where large quantities are cut down and fed to stock. *Dodonæa lobulata*, which is sometimes called "Red Fruited Hop Bush," is a tall shrub from twelve to fifteen feet high, with thick, rigid, variously shaped leaves from one inch to two inches long. This shrub grows over immense tracts of country inland, and its drought-enduring qualities are remarkable, for the torrid heat of summer, and the periodical hot winds do not appear to seriously affect its growth. In many districts it is considered one of the best forage shrubs, and sheep will often stand on their hind legs to browse upon the foliage, which otherwise would be out of their reach. Its winged fruits, which are usually produced in great abundance, have a very pleasant bitter flavour, and herbivora are remarkably fond of them. In the early days of settlement its fruits were used as a substitute for hops, hence its popular name, Hop Bush. The leaves and young branchlets of two other kinds of Hop Bush, viz., *Daviesia corymbosa* and *D. latifolia*, are much eaten by cattle and horses, even when other herbage is plentiful.

Milk Bush.—Amongst the remarkable plants indigenous to Australia few have had such widely different values assigned to them by pastoralists, stockmen, and others, as the Milk Bush (*Sarcostemma australe*). In the western portion of the continent it is regarded as a valuable forage plant, but in some parts of north-eastern Australia it has been suspected of poisoning cattle and sheep; while in Northern Australia

it is said that the aborigines use it as a therapeutic agent. When first the Milk Bush attracted the attention of the stock-owners in the western State, the Government of West Australia forwarded me a specimen for identification, and instructed me to write a report on it. The Milk Bush is found in all the States of the Commonwealth, except Tasmania, and in some sections from the coast to the far interior, but more plentifully in the hotter portions of the continent. It is a leafless shrub, with fleshy, cane-like, round branches, on the joints of which are disposed small white flowers arranged in clusters. These are succeeded by rather narrow, pod-like fruits from two to three inches long, containing a number of small seeds, each being surmounted by a tuft of silky-white hairs. The whole plant abounds in a milky juice. I have known stock in the interior of New South Wales eat this plant without any ill effects, and after numerous inquiries I have never heard of pasture animals in that State suffering from eating it. All the stockowners in West Australia, who communicated with their local Department of Agriculture agreed that the Milk Bush was a valuable forage plant for the arid districts, but that it would not stand overstocking. Mr. S. Dixon, South Australia, says that he has known cattle live upon this plant, without water, for some months of continued drought.

Mulga (*Acacia aneura*) occurs in the eastern and southern portions of the continent, and occupies large tracts of country on the droughty inlands. There are two distinct forms of Mulga which some stockowners call "Yarren," one with rather broad and the other with narrow leaves (*phyllodes*). They are usually tall shrubs, but occasionally attain the dimensions of fair sized trees and withstand a very long period of dry weather without any appreciable check to their growth. A Mulga shrub is considered a valuable asset on any station,

for the foliage is always available as feed for stock. In adverse seasons immense quantities are cut for feed, for most pasture animals are fond of the leaves and do well on them. Analyses show that Mulga foliage is of good feeding value for stock, but when sheep eat the smaller twigs fibre balls sometimes form in their stomachs. Insect galls, called "Mulga Apples," occasionally form on the shrubs, and being juicy and edible are often eaten by bushmen and others to assuage their thirst. The Mulga scrubs, when not too dense, afford partial shade and protection to several valuable nutritious grasses which are popularly known as "Mulga Grasses." The foliage of several other shrubby and sub-arboreal species of *Acacia* is good feed for stock, and largely used, particularly when the more tender grasses and pasture herbage are scarce.

Rose Bush, Rose Wood, Emu Bush, and Cabbage Bush, are the popular names given in various districts to *Heterodendron oleæfolium*, which is a tall shrub occasionally growing twenty feet high or more. It is found in the interior of all the Australian States, and is fairly plentiful on some areas. Its drought-enduring qualities are remarkable, for the hot winds that periodically blow over the inland plains, and the long periods of dry weather that are sometimes experienced there seem to have little effect upon its growth. The leaves of this shrub are from two to four inches long, and its small flowers are succeeded by seeds, each of which is partly enveloped in a red fleshy substance, largely eaten by emus; hence one of its popular names. In adverse seasons large quantities are cut, and both cattle and sheep feed upon the leaves with avidity, and seem to do well on them. Analysis show that the foliage is good feed for stock. The late Mr. K. H. Bennett, Yandembah, New South Wales, during his thirty years' experience of this shrub, used it largely as feed for stock in drought time, and regarded it as good auxiliary feed for

pasture animals. The Rose Bush in one of the few edible shrubs of the interior that will develop new growth from the stump and roots after the branches have been cut down, and to this circumstance may be attributed its fairly prolific growth in some districts.

Mr F. B. Guthrie gives the following chemical analysis of the partially dried leaves of the Rose Bush :—

Water	..	..	..	12.27
Ash	..	..	..	4.84
Fibre	..	..	..	16.36
Albuminoids	..	..	..	15.75
Carbohydrates	..	..	..	48.58

Nutrient value, 69 ; albuminoid ratio, 1:3½.

Although only some of the most important edible shrubs have been briefly described, those referred to will give an excellent idea of their value as auxiliary feed for herbivora, and the advisability of systematically conserving them for future contingencies.

FODDER TREES

The most important fodder tree indigenous to Australia is the **Kurrajong** (*Sterculia diversifolia*), an illustration of which accompanies this letterpress. In my special report to, and evidence before, the Royal Commission on Western Lands, on the economic value of the vegetation in the interior of New South Wales, I placed the Kurrajong in the front rank of trees producing feed for stock, particularly cattle and sheep.

Since that time this tree has been extensively planted in various districts. The Kurrajong is an exceedingly ornamental evergreen tree occurring in the eastern portion of the continent from the vicinity of the coast to far inland. On the eastern slopes of the dividing range it attains sometimes the height of sixty feet or more, but on the low ranges and sandhills in the interior it rarely exceeds thirty feet. This tree often grows in groups, and when viewed from a distance gives one at first sight the impression of a well-cultivated orchard. The Kurrajong is not affected by drought, nor is its growth seriously checked by the hot winds experienced in summer. Its shining green leaves, which are from two to six inches long, and arranged on long stalks, are very variable in shape, and both entire and deeply-lobed ones may be obtained from the same tree—hence its specific name *diversifolia*. Cattle and sheep are very fond of Kurrajong leaves, which are largely fed to them when pasture herbage is scarce. As a rule when the foliage of this tree is fed to stock the smaller branches only are cut off by thoughtful men, while the trunk and larger limbs are left intact, and from these there soon develops a fresh supply of twigs and leaves, which afford quantities of fodder for future requirements. The following chemical analysis of the partially dried Kurrajong leaves, by Mr. F. B. Guthrie, show them to be of good feeding value :—

Water	..	..	..	35.61
Ash	..	..	..	4.99
Fibre	..	..	..	14.54
Albuminoids	..	..	..	10.35
Carbohydrates	..	..	.	32.81

Nutrient value, 46 ; albuminoid ratio, 1:3½.

Fresh leaves would show a higher percentage of water, and, of course, would be more succulent feed. The fruit of the Kurrajong is nearly ovoid, from one and a-half to three inches



Kurrajong.

long or more, and contains about twenty seeds, each one being enclosed in a densely hairy covering, from which, however, it is easily separated. In some seasons tons of seeds are produced, and supply a part of the food of certain birds, while at one time they were largely eaten by the aborigines. It is many years since I, when in the interior, first roasted Kurrajong seeds, in an old frying-pan over a bright charcoal fire, pounded them, when sufficiently roasted, into fine particles, and made an infusion of the grounds in boiling water in a similar way to coffee, and thus obtained a capital beverage. With the addition of sugar and milk in moderate quantities the infusion becomes more palatable. Several years ago I forwarded some Kurrajong seeds to Mr. W. M. Hamlet, for analysis, and shortly afterwards he addressed to me the following communication:—"The seeds you sent me contain 1.8 per cent. of the alkaloid caffeine, and the berries, when roasted properly, are very much like coffee, indeed my assistant says he would prefer them to coffee." The roots of the young Kurrajong trees, once largely used by the aborigines as an article of food, resemble turnips in consistency, but are sweeter to the taste. From the inner bark of the tree an excellent fibre is obtained by the blacks inland, and made into very strong twine which they manufacture into nets for capturing game and fish, bags, etc. The Kurrajong is well worth strictly conserving where it is already growing and extensively planting on the droughty inlands to provide good feed in adverse seasons and shelter for stock.

This tree is easily raised from seed, and the seedlings bear transplanting well. The seeds may be sown *in situ* with every chance of success, provided the seedlings are protected against herbivora until they are large enough to take care of themselves. If the trees are grown in belts or groups they will be more easily managed.

Leopard or Spotted Tree.—In the opinion of many experienced stockowners the Leopard or Spotted Tree (*Flindersia maculosa*) stands next in value to the Kurrajong as a fodder tree. It grows from thirty to forty-five feet high or more, and its trunk is curiously spotted, hence its popular names. From its trunk and larger branches exude large quantities of amber-coloured gum of a pleasant flavour, but, as far as I am aware, it is not put to any economic use. In the eastern portion of the continent the Leopard Tree is found growing over immense tracts of country, but although fairly plentiful in some remote localities, it is not as abundant in others as formerly; indeed it is becoming scarce in many of the closer settled districts. Its smaller branchlets have a somewhat pendulous habit, which gives a well-grown specimen a decidedly ornamental appearance. During very dry periods this tree is cut down for stock feed, sheep being particularly fond of the leaves and thriving on them. Those animals indeed are so partial to the fodder that they often devour the smaller twigs, which, when eaten in excessive quantities, sometimes cause fibre balls to form in their stomachs, and result in serious trouble. The chemical analysis of the partially dried Leopard Tree leaves, by the authority above quoted gave the following results:—

Water	..	..	..	41.70
Ash	..	..	..	3.42
Fibre	..	..	..	11.43
Albuminoids	..	..	..	9.31
Carbohydrates		..	..	30.22

Nutrient value, $48\frac{1}{2}$; albuminoid ratio, $1:4\frac{1}{2}$.

Fresh leaves would show a higher percentage of water, and, of course, would be more succulent feed. The Leopard

Tree is well worth conserving on those areas on which it is already growing, and planting in the driest districts for feeding to stock during prolonged droughts. Under ordinary conditions it produces quantities of seed, which, when ripe, and sown in the ordinary way, germinates readily, so that there would be no difficulty in raising any number of plants.

Cattle Bush and White Wood are the popular names of *Atalaya hemiglauca*, a tree occurring in the eastern portion of the continent from the coast to the far interior, but far more abundantly in the latter than the former. It occasionally attains a height of thirty feet or more, and from its trunk exudes a quantity of gum which sometimes accumulates in masses, each weighing more than half a pound. It has large, divided, whitish leaves, with leaflets sometimes eight inches long, but generally smaller. Its numerous flowers are disposed in terminal clusters, and are succeeded by winged fruits, which give it an attractive appearance. At all stages of its growth this tree has a decided ornamental appearance, and is often a conspicuous object amongst the surrounding vegetation. It is one of the fodder trees that favourably attracted the attention of stockowners in the early days of pastoral occupation. When grass and other herbage temporarily fail the Cattle Bush is much cut down and the leaves fed to cattle and sheep, which seem to thrive on them. The following chemical analysis of the partially dried leaves of this tree by the authority above quoted, shows them to be of good feeding value :—

Water	..	..	..	37.55
Ash	..	..	..	6.46
Fibre	..	..	..	22.05
Albuminoids	..	..	..	11.63
Carbohydrates	..	..	..	20.58

Nutrient value, 36 ; albuminoid ratio, 1:2.

Another analysis has given slightly different results. The Cattle Bush produces an abundance of seed under ordinary conditions, and is easily reproduced, and to this circumstance may be attributed its presence in such numbers in many parts of the interior.

Colane (*Owenia acidula*) is a highly ornamental, umbrageous tree, growing about twenty-five feet high, with a symmetrical head of elegant foliage densely crowded at the ends of the branchlets. It occurs in the interior of New South Wales and Queensland, but nowhere very plentifully. The Colane is regarded as a good fodder tree, as stock have a great liking for its leaves, and cattle will eat them as high as they can reach, leaving the lower branches trimmed as neatly as if they had been clipped into shape with a pair of garden shears. The chemical analysis of the partially dried leaves of this tree, by the authority above quoted, gave the following results :—

Water	..	..	..	49.01
Ash	..	..	..	6.86
Fibre	..	..	..	12.47
Albuminoids	..	..	..	9.19
Carbohydrates	..	..	..	21.35

Nutrient value, 33 ; albuminoid ratio, 1:2½.

Although the Colane occasionally produces an abundance of fruit, which, when ripe, falls off and lies thickly upon the ground under the branches, young plants are rarely seen, as sheep and other herbivora probably devour them before they have an opportunity to grow tall. The ripe fruit is from three to four inches in circumference, the succulent outer portion being of a rich crimson colour, and rather acidulous to the taste, hence its specific name ; but it is eaten by the

white settlers and by the aborigines, and it certainly assuages thirst. The stone of the fruit is exceedingly hard. In the interior many attempts have been made to propagate this beautiful tree by ordinary methods, but I never heard of any being successful. In different parts of the interior the Colane is known by other popular names, such as "Emu Apple," "Grewie," and "Sour Plum."

Myall, Weeping Myall and "**Boree**" of the aborigines, (*Acacia pendula*) is one of the most beautiful of all the Australian wattles. It is a handsome evergreen tree, attaining sometimes a height of thirty-five feet, and occurring in more or less abundance over large areas in the interior of New South Wales and Queensland. Its pendulous, smaller branchlets, clothed with foliage of a silvery-grey colour, make it a striking object amongst the more sombre vegetation. It gives quite a distinct character to some parts of the country, and few inland trees have a more ornamental and attractive appearance. Its leaves (phyllodes) are lance-shaped and from two to five inches long, and both cattle and sheep are so partial to them that one may travel for days in country where these animals are pastured and rarely see a young plant, as the seedlings are eaten immediately they are well above the ground. In very dry seasons the Myall is largely cut down and fed to cattle and sheep, particularly the latter, and they seem to do well on it. The chemical analysis of the partially dried leaves of this tree, by the authority above quoted, gave the following results, which show they are of good feeding value :—

Water	..	..	..	48.45
Ash	..	..	..	4.45
Fibre	..	..	..	19.64
Albuminoids	..	..	..	9.62
Carbohydrates	..	..	..	16.63

Nutrient value, 29 ; albuminoid ratio, 1:2.

This very useful tree is easily re-established where it was once growing by keeping cattle and sheep from browsing on the young plants, which develop from the seed lying in the ground, until they are sufficiently tall and strong to take care of themselves. Horses may be allowed to graze in paddocks where the young Myalls are growing, for they do not eat the leaves. When allowed to grow undisturbed for a time the Myall produces an abundance of seeds which, when mature, retain their vitality for many years, and sometimes lie in the ground for a very long period, indeed until the weather and soil conditions are favourable for their germination. The Myall is well worth conserving, and extensively cultivating in the interior, both for its fodder value and for its very useful timber. It is easily raised from seed sown *in situ*, and as the resulting plants grow fairly rapidly when protected from stock, there will be no difficulty in doing this. A well-grown specimen has a trunk about three feet in circumference and yields an excellent timber, which is heavy, close in the grain, and of a rich, dark-brown colour, and beautifully marked having a delightful fragrance of violets, which it retains for a long time after being cut.

Quandong (*Fusanus acuminatus*) occurs in all the Australian States, but principally in the hotter and drier parts. It attains a height of from twenty to thirty feet, and has lance-shaped leaves from two to three inches long. Its drought-enduring properties are remarkable, for its growth seems to be affected neither by dry weather nor by the hot winds which periodically blow over the interior. It is a useful fodder-producing and important fruit-bearing tree, whose foliage is much relished by cattle and sheep, and they often eat the young plants, even when grass and herbage on the grazing areas are plentiful. The fruit of the Quandong, occasionally called Native Peach, is red when ripe, from one and a-half to

three inches in circumference, and of considerable economic value. The succulent outer part is edible, and makes an excellent conserve and jelly, somewhat of the same flavour as guava. It can also be used for tarts and pies. When the stones have been extracted, the dried remainder may be kept and used at convenience like other dried fruits. The hard, curiously pitted stones are used for necklaces, bracelets, and other ornaments. The edible kernels have a pleasant flavour and contain a large percentage of oil, which when burned gives a good light. There is a variety of the Quandong with yellow fruit which I discovered in the interior, but it is a very rare tree. The fruit is larger, and the edible outer covering thicker than that of the red kind, and therefore, of greater economic value. The Quandong is easily raised from matured fresh seed.

Wilga (*Geijera parviflora*) is found in all the Australian States from the coast to the far interior, but is much more abundant in the latter than the former. It may often be seen growing as a tall shrub, but it finally attains a height of about thirty feet. It has slender, often pendulous, branchlets clothed with narrow leaves from three to six inches long, and a well-grown specimen has a highly ornamental appearance, and somewhat resembles the "Weeping Willow," hence one of its popular names. Stockmen also call this species "Sheep Bush." Many admirers of Australian vegetation regard the Wilga as the most graceful tree in the arid interior. Its drought-enduring qualities are remarkable, as it will continue to grow under the most adverse climatic conditions. It is fairly plentiful in some situations, although it has been much cut down for feeding to stock, particularly sheep, which eat the leaves readily and seem to do well on them. As regards the feeding value of the Wilga, experienced stockowners hold dissimilar views, and some say its economic importance

varies in widely separated localities and on different geological formations. Chemical analyses also show slight variability. The chemical analysis of the partially dried leaves of this tree, by the authority above quoted, gave the following results :—

Water	..	..	..	47.73
Ash	..	..	..	5.21
Fibre	..	..	..	7.61
Albuminoids		..	..	14.25
Carbohydrates		..	..	23.02

Nutrient value, 42 ; albuminoid ratio, 1:2.

In ordinary seasons the Wilga produces quantities of seed which germinate readily under ordinary conditions.

Although the fodder trees referred to above, are the most widely and favourably known to stockowners, there are several others that provide feed for stock when ordinary pasture herbage fails. Amongst them may be mentioned Apple Tree (*Angophora intermedia*), Beef Wood (*Grevillea striata*), Belar (*Casuarina glauca*), Motherhumba (*Acacia glaucescens*), Sandal Wood (*Myoporum platycarpum*), She-Oak (*Casuarina stricta*), Sugar Gum (*Eucalyptus corynocalyx*), and Supple Jack (*Ventilago viminalis*).

SOME ACCLIMATISED AND CULTIVATED EXOTIC GRASSES AND FORAGE PLANTS.

GRASSES.

In the coast and more settled districts where there is a good average rainfall the following exotic grasses have been cultivated for many years with more or less success, and some of the hardier ones have become acclimatised in the native pastures and provide useful auxiliary feed when the weather conditions are favourable for their growth.

Bancroft Grass (*Panicum muticum*) is a rapid-growing plant of straggling habit thriving only in the warmer coast districts where it yields a bulk of succulent, rich herbage much liked by dairy cattle which do well on it. This vigorous-growing grass should not be cultivated with other pasture grasses, but rather as an auxiliary crop. This species is sometimes called "Para Grass."

Different kinds of **Canary Grass** have long been acclimatised in Australia, and they have a certain economic value in the pastures in early summer. But *Phalaris bulbosa*, the more recently introduced Canary Grass, is the most important, from a stockowner's point of view. Since I recommended its cultivation in New England and in the colder districts generally, it has come greatly into favour as winter feed for stock. It is a strong, rapid-growing grass attaining a height of seven or eight feet when allowed to grow undisturbed for a time, and produces a great bulk of palatable, leafy herbage on which herbivora of all kinds do well and fatten readily. Unless this grass is cultivated for hay or ensilage it should be kept in a comparatively dwarf

condition by allowing stock to keep it fairly well eaten down, for the young growth is more eagerly sought after than the older stems and leaves. The seeds of this grass should be sown in early autumn, and if possible after rainfall; then quick germination will be assured and the resulting grass will make considerable headway before the cool season sets in.

Cocksfoot (*Dactylis glomerata*) is perhaps the most generally useful of all the introduced pasture grasses, but thrives only in the cooler and colder parts of the continent. It does well on a variety of soils, but grows taller and yields more and better herbage on fairly strong land. In a young state this grass is greedily eaten by all kinds of stock, which fatten readily on it. Cocksfoot can be cut for hay, and the aftermath provides good grazing till late autumn. Mueller and Rummel give the following chemical analysis made on the late spring growth of this grass:—Albumen, 1.87; gluten, 7.11; starch, 1.05; gum, 4.47; sugar, 3.19 per cent.

Crested Dog's Tail (*Cynosurus cristatus*) is a dwarf, compact-growing, deep-rooted grass capable of withstanding much dry weather. Its chief value is for permanent sheep pasture, and its nutritious herbage is much liked by all herbivora. In the colder districts it also makes a good lawn grass.

Fescues.—Several kinds of Fescue do well in Australia and are suitable for sowing in grass mixtures. Amongst the best are the following:—Hard Fescue (*Festuca ovina*, var. *duriuscula*) is an excellent hardy grass, growing about eighteen inches high, producing the best yield of herbage on light, loamy soils. It will not thrive on strong, clayey land. Its nutritious herbage is much relished by all herbivora. Chewing's Fescue is a sub-variety of the Hard Fescue, and is well worth growing under similar conditions. The Red or Creeping Fescue (*Festuca ovina*, var. *rubra*) is, on account of its creeping

habit, a desirable grass for binding loose, sandy land, or for growing on light soils liable to periodical inundation. It is a capital pasture grass, and under favourable conditions attains a height of from two to three feet. Sheep's Fescue (*Festuca ovina*) is a good grass for the coldest districts. Tall Fescue (*Festuca elatior*) is a vigorous grass, and on strong, moist land attains a height of from three to five feet, and yields a great quantity of herbage much relished by stock. Mueller and Rummel give the following chemical analysis made on the spring growth of this grass :—Albumen, 2.47 ; gluten, 2.75 ; starch, 0.50 ; gum, 2.84 ; sugar, 2.84 per cent. The Meadow Fescue, sometimes described under the botanical name, *Festuca pratensis*, is a variety of the Tall Fescue. It usually grows about two feet high, thrives on moist land and produces a quantity of succulent herbage much liked by cattle.

Guinea Grass (*Panicum maximum*) thrives only in the warmer coast districts where it attains a height of from four to six feet. In favourable situations it produces an immense amount of succulent, nutritious, leafy herbage much relished by cattle and horses. It will yield several large cuttings during the summer months, and if cut before it begins to seed it can be made into excellent hay. Guinea Grass should be kept fairly well eaten down in order to promote succulent, young growth, for if allowed to mature, the stems are tough and cane-like and the herbage harsh.

Hungarian Forage Grass (*Bromus inermis*) grows from two to three feet high, and on light, rich, loamy soils produces a large amount of nutritious herbage much relished by all herbivora, which do well and fatten on it.

Meadow Fox Tail (*Alopecurus pratensis*) usually attains a height of two feet, and thrives on rich, strong loams and even on clayey land. During the first year after sowing it gives

only a small yield, but after that it produces abundant annual crops of nutritious, leafy herbage greedily eaten by stock which thrive and fatten on it. If cut just at the flowering period Meadow Fox Tail can be made into excellent hay. This grass withstands extreme cold, and being one of the earliest to develop leaves in spring, is a welcome addition to the pasture herbage.

Paspalum dilatatum is a botanical name with which the man on the land has become familiar, and even children on a dairy farm pronounce it as correctly as if the words were part of the English language. In the dairying districts this grass is largely cultivated, and is particularly suitable feed for milch cattle. It thrives in the warmer coast districts in deep, rich soil where a good rainfall can be depended upon, but should be kept well eaten down to prevent it growing into objectionable tussocks, for in that condition it is most difficult to eradicate.

Paspalum virgatum is a more erect and coarser-growing grass than the one previously described, and will thrive under cooler and drier climatic conditions. Under ordinary cultivation it produces a large amount of herbage which is good stock feed. If this grass is cut when in flower it can be made into good hay, and probably would be useful for ensilage.

Perennial Rye (*Lolium perenne*) is the most widely and best known of all the exotic grasses introduced into Australia. There are quite a number of varieties of it—computed by some European and American authorities at more than fifty—some being much superior to others. The Italian Rye Grass (*Lolium italicum* of some botanists) is one of its many varieties. It is an excellent pasture grass, growing from eighteen inches to two feet high or more, doing best in the cooler and colder districts, fairly well on average soils, and thriving on rich, alluvial, strong land. Under favourable conditions it pro-

duces a quantity of nutritious herbage which is relished by all kinds of stock. In late winter and early spring it makes considerable growth in favourable situations, and is then a valuable addition to the otherwise often dry pasturage. Rye Grass thrives under irrigation, and can be kept in a growing state and beautifully green throughout the summer months under such conditions. If cut at the flowering stage it makes capital hay. Mueller and Rummel give the following chemical analysis, made on the spring growth of this grass :—Albumen, 3.36 ; gluten, 4.88 ; starch, 0.51 ; gum, 1.80 ; sugar 1.80 per cent.

Prairie Grass (*Ceratochloa unioides*) is one of the best exotic grasses ever introduced into Australia. Under favourable conditions I have seen this grass growing nearly four feet high, but generally it is not so tall. When cultivated on deep, rich land it produces heavy crops of succulent, nutritious, leafy herbage on which all kinds of stock thrive. Prairie Grass will afford five or six cuttings in the year if mown before it begins to flower. It is a first-class pasture grass, and if cut when in bloom can be made into excellent hay. Owing to its free seeding qualities, and the easy germination of its seeds, it readily becomes acclimatised where the conditions are favourable. When growing in pastures with other grasses it should be judiciously grazed, for stock are so partial to it that there would be a possibility of its being eaten out. Mueller and Rummel give the following chemical analysis made on the spring growth of this grass :—Albumen, 2.80 ; gluten, 3.80 ; starch, 3.30 ; gum, 1.70 ; sugar, 2.30 per cent.

Red Top Grass (*Tricholæna rosea*) has readily adapted itself to Australian climatic conditions and is now to be found in many pastures in the warmer coast districts. It grows from two to three feet high or more, and withstands dry weather, but is injured by sharp frosts. On rich land it

produces a bulk of nutritious, leafy herbage on which stock do well. If cut when in flower it makes very fine hay and chaff. The Red Top Grass will not stand close grazing, but it soon recuperates when the paddocks are lightly stocked.

Smooth Stalked Meadow Grass (*Poa pratensis*), (called "Kentucky Blue Grass" in America, where it is largely cultivated and held in high repute by stockowners), grows from one foot to two feet high, and thrives on different geological formations in the cooler coast areas, and on the cold tablelands. In permanent pasture it is one of the first grasses to start into growth in early spring, and from that time till early summer, and throughout that season if it is a favourable one, it yields a fair quantity of fine, nutritious herbage much liked by all herbivora. In most situations it forms a dense turf of a dark bluish-green colour, and in consequence is a very popular lawn-grass. This grass should never be sown on land intended for subsequent cultivation, for after being laid down for some years it develops a very strong root system which is difficult to eradicate.

South African Rhodes Grass (*Chloris gayana*) thrives in districts not subject to sharp frosts, but attains greater perfection near the coast than far inland unless irrigation is possible. In a young state it develops numerous running stems, which root at every joint. After these have covered the ground allotted to them, the shoots assume an upright position, finally attaining a height of from four to six feet or more. Under ordinary conditions it yields an immense quantity of herbage, which is readily eaten by all kinds of stock, which thrive on it. This luxuriant grass should not be grown in pastures amongst dwarf ones, as it would be likely to suppress them in a short time. If cut when in flower this South African grass can be made into excellent hay, and the green herbage can be chaffed and fed to stock. The following chemical analysis, made by

Mr. J. C. Brunnich, has shown that this grass has not such high feeding value as the Australian Rhodes Grass :—

Moisture, 9.19 ; ash, 12.00 ; fibre, 27.24 ; carbohydrates, 42.15 ; fat and oil, 1.00 ; protein, 8.42 ; total nutriments, 51.57 ; albuminoid ratio, 9.28 per cent.

Sweet Scented Vernal Grass (*Anthoxanthum odoratum*) grows from twelve to fifteen inches high, but thrives only in the cooler districts. It has a favourable reputation for two qualities—in early spring it makes considerable growth which is much relished by stock, and it possesses a perfume (the active principle of which is coumarine) which it imparts to hay.

Texas Blue Grass (*Poa arachnifera*) is a rapid-growing plant, with creeping stems, which does well in the cooler inland districts, and withstands dry weather. It is an excellent grass for permanent pasture, as it will stand close grazing, and its herbage is liked by all herbivora.

Timothy Grass (*Phleum pratense*) grows from two to three feet high, rooting deeply on different classes of land, and forming tolerably compact tufts in the cooler and colder districts. It luxuriates on deep, moist loams, and strong land, even doing well on clayey formations. In dry situations its growth is stunted, and it begins to grow thin after a few years. It is a valuable grass for both permanent and temporary pasture, and, as it begins to grow in very early spring, is a most valuable addition to the herbage. Under favourable conditions it yields a great bulk of succulent, nutritious, broad leaves on which all herbivora thrive. It will stand fairly close grazing, and thrives under irrigation for about three years, when it should be renewed to obtain the best results. Timothy Grass makes excellent hay if cut at the flowering period or shortly after ; and can be mown as green feed for stock.

ANNUAL GRASSES GROWN FOR AUXILIARY FEED FOR STOCK.

In the dairying districts, and inland where irrigation is possible, the cultivation of tall-growing grasses of annual duration, as for example, Maize, Millets, and Sorghums, as auxiliary feed for stock is carried on to a greater or less extent to provide the cattle with good, nutritious feed when there is a deficiency of herbage in the pastures, or to supplement the feed where the grazing areas are limited. These are usually cut green and judiciously fed to stock from day to day, or reaped and turned into hay or ensilage, and used as occasion may demand.

MAIZE.

It is generally recognised that no other crop makes better auxiliary feed for milking cattle than maize, either fed fresh and succulent from the field or made into ensilage and used as required. The variety known as "Ninety-Day" is one of the best to grow for green feed, and the white-seeded varieties are amongst the best for ensilage. Maize that is grown for green feed can be successfully cultivated on various classes of land, but the best and heaviest yields are obtained on deep, rich, alluvial soils. The seed may be sown at intervals from September to January, or February in the warmer districts, broadcast or by drills; if by the former method, one bushel will be required to sow an acre, but if drilled in one-fourth of that quantity will suffice. The seed sown broadcast should be lightly harrowed into the soil, and then rolled with a light roller. If the land was fairly clean when the seed was sown, the crop will out-grow and suppress any ordinary farm weeds that may spring up. The crop that was drilled in can be cultivated in the ordinary way, and kept clean of weeds until

the plants are able to take care of themselves. Much heavier green crops can be obtained by this method, and, moreover, they can be easily harvested by machinery. It is very necessary to exercise great discretion when feeding succulent, green feed to stock, more particularly during the first few days, as it is safer to give too little than too much.

MILLETS.

Hungarian Millet (*Setaria italica*) of which there are many varieties, including those known as French and Italian, are excellent, rapid-growing nutritious grasses, with compact, bristly seed heads. They attain a height of from three to four feet or more, and form large masses of strong, fibrous roots, drawing their nourishment largely from the surface soil, and when grown on newly broken up land have an ameliorating effect upon it. Millets give the largest returns when cultivated on rich, friable, loamy soils. Where a heavy yield is expected the land must be thoroughly worked and brought to a fine tilth before the crop is put in. In the warmer coast districts the seed may be sown any time from September to January, but in the cooler parts October to December will be found the best time. The precise time to sow the seed in those months will be when the weather and soil conditions permit, if dependent on rainfall. The seed may be drilled in or sown broadcast. Generally there is little, if any, choice between the two methods when the crop is grown for green feed or cut for hay, except that the drilled in seed usually results in a more even growth, and a little less seed is required. Where the crop is grown for grain or ensilage, it is advisable to drill the seed in. By this method it takes ten pounds weight of seed to sow an acre, but if sown broadcast fifteen to twenty pounds will be required for the same area. Well-tilled, rich land will require less seed than that which lacks fertility, and

it is not necessary to use as much seed for a green crop as for one intended for hay. A thinly-grown crop has generally coarse stems, which are not desirable for hay. Under favourable conditions during the hotter months some of the varieties will be ready for cutting for green feed for stock in about a month or five weeks from the time the seed was sown. The proper stage of growth at which to cut Millet for green feed, hay, or ensilage, is when the majority of the flower heads appear. The mowing must never be delayed until the seed begins to ripen, especially if the herbage is fed to horses, as the bristly seed-heads would be likely to cause trouble to their salivary glands. If Millet is cut at the stage recommended, the aftermath is often considerable, and makes good temporary pasture for stock. All pasture animals thrive on the herbage of these plants, whether green or dry. Some tests that have been made have shown that in Hungarian Millet hay sixty-five per cent. of the total dry matter is digestible, and of the green material sixty-three per cent. As the hay ordinarily contains from seven to fifteen per cent. of water, leaving a total amount of from eighty-five to ninety-three per cent. of dry matter, or eighty-five to ninety-three pounds in each one hundred pounds weight of hay, it will be seen that the animal digests from fifty-four and a quarter pounds to sixty and a half pounds of total dry matter in each one hundred pounds of hay.

Japanese Millet is a rapid-growing grass yielding a large amount of green feed, much relished by all herbivora.

Manchurian Millet is dwarf in habit, but hardy and prolific. Both these Millets thrive under similar cultural conditions to the Hungarian Millet.

Panicum miliaceum is a distinct Millet growing from three to five feet high and yielding a bulk of herbage of which stock

are fond and on which they do well. It is a very easily cultivated grass and thrives under exactly similar conditions to the Millets referred to above. There are several varieties of it, all of which grow rapidly and come early to maturity. A good crop will yield from fifty to sixty bushels of grain per acre, and it is excellent feed for poultry. The milled grain can be made into good and nutritious porridge and cakes, for which many persons have a decided liking.

Pearl Millet (*Penicillaria spicata*) is a rapid-growing grass, finally attaining a height of eight or ten feet or more, yielding a remarkable amount of herbage, which is much relished by stock, but is not considered such valuable feed as that produced by some other kinds of Millet. This grass will thrive only on rich land in the warmer districts. The seeds are borne in dense spikes about fifteen inches long, and are of considerable economic value in some eastern countries, where they form an important article of food for the population. The seed should be sown in October and November, at the rate of from ten to twelve pounds per acre if broadcasted, but a less quantity will suffice if sown in drills three feet apart.

The two following grasses are not true Millets, but are grown and thrive under similar cultural conditions.

Teff (*Eragrostis abyssinica*) grows from two to four feet high, and produces a quantity of good leafy herbage of considerable value for stock feed. It is a very rapid-growing grass coming to maturity in about two months. If cut when in flower it makes very good hay, and the aftermath is considerable and provides useful temporary pasturage. The seed should be sown at the rate of from five to seven pounds to the acre.

Teosinte (*Euchlæna luxurians*) is one of the most productive grasses in the world, but it requires rich soil, heat and

moisture to attain perfection. It is essentially a summer grass. One seedling will often develop thirty-five stems, which grow sixteen feet high in a few months, and this wonderful growth has been exceeded under very favourable conditions. To obtain such results Teosinte must have plenty of room. Although this tall grass produces leaves about three feet long, and three inches wide in the middle, the herbage is by no means coarse. The young succulent stems contain a good percentage of saccharine matter, and all parts of the plant are greedily eaten by stock. The most economical way of feeding this grass to dairy cattle is to cut it when a few feet high, and under ordinary conditions three crops from the same roots will be obtained in one season. The seeds should be planted in October and November in rows four feet apart, with a similar distance between the seeds in the rows.

SORGHUMS

Sorghums are divided into two classes, viz., the saccharine and the non-saccharine. The former have long been cultivated in the dairying districts, and few grasses are held in such esteem as auxiliary feed for milch cows. Dairy cattle judiciously fed on them do remarkably well, and yield large quantities of milk. Most kinds of stock fatten readily on these grasses, but care must be taken not to give the animals too much at a time, or they will be likely to get blown (hoven), and probably die. Moreover, Sorghum, whilst very young contains a deadly poison known as hydrocyanic acid, and until it is at least seven weeks old should not be fed to stock. Notwithstanding these serious drawbacks, Sorghum is not only an exceedingly valuable auxiliary green feed, but makes capital hay, and with care, good ensilage. Sorghums do not constitute what may be termed a "balanced ration;" still a less quantity of grain will be required to make good the

deficiency than with Maize. Good crops of the different varieties of Sorghum can be raised on various classes of fertile, friable soils, but they produce the heaviest yields of herbage when cultivated on deep, rich, friable loams. The land for Sorghum should be brought to a good tilth before the crop is put in. The seed should be sown in summer, but not before the ground is thoroughly warm, as cold, damp weather will often prevent germination and vigorous growth after the seed has sprouted. If the crop is required for hay, it is best to sow the seed broadcast at the rate of one bushel to the acre, then the resulting seedlings will not develop coarse stems. Crops intended as auxilliary feed in a matured state should be drilled in at the rate of from ten to fifteen pounds' weight of seed to the acre. The proper time to cut Sorghum for feeding to stock has always been a problem with growers. Many experienced dairymen do not cut the crop until the first flowers appear, as they consider that the plant has not developed its highest nutritive qualities until then. In the warmer and more humid districts, the aftermath from a Sorghum hay crop is often considerable, and makes excellent stock feed. Dairymen sometimes cut broadcasted Sorghum when from three to four feet high, and continue cutting the aftermath throughout the season.

The following varieties of saccharine Sorghum are amongst the more favourably known :—

Early Amber Cane is a rather quick-growing variety, and certainly one of the best and sweetest of the Sorghums. Cattle are remarkably fond of the plant, and thrive on it. Under ordinary conditions this variety will yield three large cuttings in one season.

Planters' Friend (brown seed) is a favourite variety with stockowners. It is of slower growth and coarser in the stalk

than the one previously described, but is a valuable and productive forage plant.

Sorghum saccharatum (black seed) has a branching habit and is an excellent forage plant. The newly introduced Sorghum, "Saccaline," promises to be a valuable addition to this class of forage plants.

The non-saccharine or grain Sorghums resist drought to a greater degree than the others, and are better suited to the dry districts. They thrive under the same cultural conditions, and amongst the best are :—

Kaffir Corn.—This variety of Sorghum is considered the best to grow where grain is the chief consideration. Its stalks and leaves are palatable to stock, while the chaffed plant is good feed for horses. In some tests with Kaffir Corn and Maize, the results were greatly in favour of the former, which produced from forty to fifty bushels of grain per acre in a dry season. The seed is excellent feed for poultry.

Jerusalem Corn, although of comparatively dwarf habit, yields a quantity of good feed, and withstands drought. It produces large heads of grain which is nearly flat and pure white.

Sudan Sorghum or **Sudan Grass** which, like its congeners, resists drought, grows tall, yielding a quantity of palatable herbage, and makes good hay and chaff. It is said to have a laxative effect on stock that eat much of it. In the humid coast districts the leaves become affected with fungoid growth.

Other varieties of Sorghum are cultivated to a less extent.

CLOVERS AND ALLIED FORAGE PLANTS.

Lucerne (*Medicago sativa*) is the most largely cultivated exotic forage plant in Australia, and certainly is the most important member of the pea-flowering family to grow as auxiliary feed for stock. It can be successfully cultivated, however, only on the deepest and richest of soils. This crop attains perfection on the rich alluvial flats bordering the rivers, but when grown in the interior in similar situations it requires liberal irrigation. Lucerne has a very strong and deep root system, and when once established in favourable situations is wonderfully productive. In ordinary seasons from three to five good cuttings of nutritious herbage can be obtained annually. Stock of all kinds are fond of lucerne, either in a green state or when made into hay, and they do well and fatten on it. Milking cattle that are given fair supplies of green Lucerne, will keep up their yield of milk, even when the pasture herbage is dry. As regards the chemical composition of Lucerne, Mueller and Rummel give the following analysis made on the early spring growth:—Starch, 1.5; gum, 2.1; unfermentable sugar, 3.0; albumen, 2.3; insoluble proteins, 2.3; ash, 2.3 per cent.

FEEDING VALUE OF LUCERNE HAY.

(Analyses determined by Professors Jenkins and Winton.)

	Per cent.			
Water	16.5
Ash	6.8
Albuminoids	16.0
Fibre	26.6
Nitrogen (free extract)			..	31.6
Fat	2.5
				100.0

The percentage of digestible matter :—

Albuminoids	12.61
Fibre	13.00
Nitrogen (free extract) ..	24.50
Fat	0.80

Land intended for Lucerne must be deeply and thoroughly worked and brought to a fine tilth before the crop is put in. March and April are good months to sow the seed, and in favourable seasons early spring sowing has proved a success. The seed may be either drilled in or sown broadcast ; if the former method is adopted ten pounds' weight of seed will be sufficient to sow an acre, while the latter requires fifteen pounds of seed for the same area. The drills may be any distance from nine to fifteen inches apart, according to the nature of the soil—the widest distances on the richest land. The crop is cut at various stages of its growth as auxiliary green feed for stock, but Lucerne possesses its highest nutritive properties when in flower, and experienced men cut it, as far as practicable, at that stage for green feed or for hay. This crop may be considered in its prime from the second to the seventh year from seed, but under favourable conditions it will continue for many years to produce an abundance of succulent herbage. If Lucerne is grown solely for grazing purposes care must be taken not to allow the crop to be eaten too closely or considerable injury may be done to it. Of all grazing animals, sheep, if allowed to remain too long on the crop, do it most harm, as they eat out the crown of the plant, which not only retards its recuperation, but often kills it outright.

Alsike Clover (*Trifolium hybridum*) is, according to some authorities, of hybrid origin. It has branching hollow stems, almost egg-shaped leaflets, and pink or white flowers, which

turn brown as they fade, arranged in dense clusters on long stalks. On moist, rich meadow land it yields a heavy crop of excellent herbage much liked by all kinds of stock. This clover thrives under irrigation. If the weather and soil conditions are favourable the seeds should be sown in August or September, otherwise in March or April, at the rate of from two to four pounds weight of seed per acre in mixtures, but if sown alone, from twelve to fifteen pounds will be required for a similar area. The seed should be sown evenly over the surface of well-tilled land, and lightly harrowed, after which the ground should be lightly rolled to make it firm about the seed. This treatment applies to the seeds of all clovers that are sown alone.

Bird's Foot Trefoil (*Lotus major*) is one of the most useful fodder plants for swampy land, where it will often attain a height of two feet, and provide an abundance of feed on which stock of all kinds do well.

Bokhara Clover (*Melilotus alba*), sometimes called sweet clover, is a biennial plant, but in favourable situations it will continue growing for many years. When allowed to grow undisturbed it attains sometimes a height of six feet, and produces a large bulk of sweetly-scented herbage—the active principle being coumarine. Bokhara Clover is useful for mixing with hay, and when mixed with other strong-growing plants it makes good ensilage. It may be used for green manuring if ploughed into the land whilst it is young. Its small, white flowers, which are produced in profusion, are much visited by bees. Two additional species of *Melilotus* viz., *M. officinalis*, and *M. parviflora*, occur more or less plentifully in many pastures in various parts of the continent. The former is usually a biennial and the latter an annual, both have sweetly-scented foliage, and produce useful feed for stock in spring.

Broad or Red Clover (*Trifolium pratense*) is a biennial plant with fibrous roots and branching, hollow stems clothed with fine hairs. Its leaflets are almost egg-shaped, covered with fine hairs, and strongly marked with a whitish band near the centre. The flowers are a dull, rosy purple, and arranged in dense heads on rather long stalks. In the colder districts having a good average rainfall it makes rapid growth and gives an ample and quick yield of excellent herbage, highly valued as feed for stock.

Cow Grass or Perennial Red Clover (*Trifolium pratense perenne*) has a long tapering root penetrating deeply into the earth, and erect, branching and generally solid stems tinged with purple. Its leaflets are broadly lance-shaped and distinctly marked with a whitish band near the middle. The flowers, which are deep purple, are disposed in dense heads on rather long stalks. Under favourable conditions in the colder districts, this clover yields an immense quantity of rich, succulent herbage, much liked by all herbivora which thrive on it. If cut when in flower it makes excellent hay. This and the preceding clover are often confused by farmers, for there are several strains of both, differing more or less from the typical forms.

Clustered Clover (*Trifolium glomeratum*) is an annual occupying fairly large areas both in the coast districts and many inland parts. In late winter and throughout the spring this exotic clover affords a fair amount of good feed for stock.

Egyptian Clover (*Trifolium alexandrinum*) is an annual growing two feet high or more, doing well on comparatively inferior land, and withstanding more heat and dry weather than most other kinds of clover. It is a very productive plant, and its herbage is much valued as feed for stock. It thrives under irrigation.

Japanese Clover (*Lespedeza striata*) is an annual plant thriving on almost any class of soil, and in any situation. It withstands dry weather and forms a dense growth, which analysis has shown to be as rich in albuminous substances as the best clovers. It is much relished by all kinds of stock.

Sainfoin or Esparecette (*Onobrychis sativa*) is a deep-rooting plant growing from two to three feet high with stems well clothed with divided leaves. It grows best on limestone formations, and in an ordinary season produces a quantity of succulent herbage much relished by stock. If the plant is cut when in flower it can be made into good hay. With ordinary care and attention, Sainfoin will maintain its vigour for eight or ten years, and yield two good cuttings annually.

Scarlet or Crimson Clover (*Trifolium incarnatum*) is an annual, though in favourable situations it may be a biennial. This rapid growing, very productive plant is a good auxiliary forage crop for stock, and makes capital hay. When growing this clover for green feed or for hay, care must be taken to cut it at the early flowering stage, for if the seeds are allowed to ripen the bristly hairs surrounding them may cause trouble to the animals which eat the herbage. The scarlet clover is one of the best plants to plough into the ground for green manure.

Shearman's Clover is spreading on rich, moist land in the coast districts. Under favourable conditions it produces a large bulk of succulent herbage much relished by dairy cattle, which are said to thrive on it.

Strawberry Clover (*Trifolium fragiferum*) has quite distinct characteristics, and during recent years has spread very much in pastures from the coast to a considerable distance inland. It has a creeping habit, trifoliate leaves, and rose coloured flowers, and when the seeds are maturing the heads become swollen and resemble strawberries—hence its popular

name. In favourable situations it produces a fair amount of rich, succulent herbage, of which stock are fond and on which they do well.

Suckling Clover (*Trifolium minus*) is a slender annual plant with small, yellow flowers, growing plentifully in the pastures in the coast areas, and in some of the more favoured districts. After the autumn rains this clover springs up readily and continues to grow during the winter and spring months, but when the hot weather sets in, it gradually dies. During the growing period its herbage is much relished by stock, and if cut when in flower it makes capital hay.

Subterranean Clover (*Trifolium subterraneum*) has spread in many districts during recent years and forms a good percentage of the herbage in some pastures in favourable seasons. The stems of this annual clover grow close to the ground, and its herbage is palatable to stock, sheep being partial to it. Its flowers are white or pale pink, and after the seeds have formed, the stalks on which they are disposed turn down and press into the loose earth to mature and eventually germinate. From this circumstance it takes its specific and popular names.

Sulla or Soola Clover (*Hedysarum coronarium*) grows about three feet high and has a bushy habit, while its stems are well clothed with foliage. It thrives in the more favoured districts on deep, fertile, strong land that is neither too wet nor too dry. Sulla is an excellent forage plant, and in ordinary seasons yields a bulk of succulent, nutritious herbage much liked by cattle. If cut when the flower stems first appear it can be made into good hay.

Tare or Vetch (*Vicia sativa*) is a valuable and productive auxiliary forage plant yielding under favourable conditions eight tons or more of excellent herbage per acre. It is an easily cultivated crop thriving on well-worked, rather strong

land, but doing well on various classes of soils. Its herbage is greedily eaten by all kinds of stock, and dairy cattle thrive and milk well on it. If cut when in flower it makes capital hay or good ensilage, and is a useful plant to plough into the ground as green manure. When this tare is grown for green feed it is sometimes sown with Barley, Oats or Rye, which support its numerous slender stems, thus helping to secure a better and heavier crop, and at the same time making it easier to be cut and fed to stock. If the tare is cultivated alone one and a-half to two bushels of seed should be sown to the acre, but if grown with the above-mentioned crops, one bushel of seed, or a little more will suffice for a similar area. This plant is acclimatised in some pastures.

Trefoil (*Medicago denticulata*) has spread naturally over a larger area of country than any other member of the Pea flowering family. After autumn rains this annual plant springs up in great profusion, sometimes partially covering millions of acres with nutritious herbage, of which all classes of stock are remarkably fond and on which they readily fatten. In November and December this trefoil usually dies, leaving the land where it has been growing strewn with seed pods popularly known as "burrs," and although these are objectionable from a woolgrower's point of view, they are good feed for sheep which will not only keep in fine condition, but grow fat on them.

The Spotted-Leaved Trefoil (*M. maculata*) is equally valuable as feed for stock, but it is not nearly as plentiful. Two burrless Trefoils (*M. orbicularis* and *M. scutellata*) have been cultivated, and are also growing in some pastures as escapees, but they do not spread much. They are excellent forage plants of which sheep are particularly fond. In the coldest districts another Trefoil (*M. lupulina*) of biennial

duration has been cultivated with some success, and is a useful pasture plant.

White Clover (*Trifolium repens*) is a very prominent plant in many pastures in the dairying districts ; the seeds in many instances having been disseminated by cattle, for their vitality is not impaired by the process of digestion. During spring some pastures are literally white with the flowers of this clover. It has a creeping habit, rooting at every joint that comes in contact with the ground, and producing a fair amount of nutritious herbage of which all kinds of stock are remarkably fond and on which they thrive. Several other kinds of clover are becoming naturalised in some pastures in the more favoured districts, and are useful forage plants.

MISCELLANEOUS AND FORAGE PLANTS.

Burnet, sometimes called Sheep Burnet (*Poterium sanguisorba*), is a rather tall-growing plant with a long tap-root which penetrates deeply into friable soils, and is thus enabled to withstand a long period of dry weather without its growth being checked to any serious extent. It is grown on land termed (loose granitic country), with success as sheep pasture, these animals fattening on the ample herbage.

The following plants are occasionally cultivated for winter feed for stock :—Cattle Cabbage, Chou Moellier, Rape, and Thousand Headed Kale—all members of the Cabbage family. Cattle Melon, Cattle Pumpkin, Cow Pea, Swede Turnip, and similar useful plants have also received attention. Oats and Wheat are more largely cultivated for hay than any other cereals.

HINTS ON LAYING DOWN PERMANENT PASTURE.

Land that is intended for permanent pasture must be deeply and thoroughly worked, and brought to a fine tilth. It is too often supposed that any kind of land is good enough for permanent pasture, but no greater fallacy exists. Most of the valuable and nutritious grasses and forage plants require as good land to grow on, and as much attention as many other important crops. If infertile land has to be devoted to permanent pasture it should be enriched with farm-yard or other natural manures, and these should be well ploughed into the ground some weeks before the sowing takes place. Failing these, bone dust is an excellent fertilizer for grass, and may be applied at the rate of three cwt. or more per acre, according to the condition of the land. The areas to be devoted to temporary pasture, or to auxiliary green crops, must be prepared on the same liberal lines, in order to obtain the best results. The selection of grasses suitable for the different districts will require a great deal of care, but any work in that direction will be greatly facilitated by referring to the descriptions of the various species embodied in this book. If possible, grass seeds should be obtained from old pastures that have been judiciously grazed, and have received careful attention for many years, then a high percentage will germinate, and develop vigorous growth. Care should be taken to sow only clean seeds, otherwise there will be a possibility of introducing undesirable weeds. Except in the coldest parts of the country the best time to sow grass seeds is in autumn, and the best months are March and April, but later sowings may be made in the warmer districts, especially if the season be a favourable one. August and September are the best months in spring to sow, but all sowings should be completed by that time, as it is imperative for the young plants to be well

established before the hot weather sets in. When the season for sowing has arrived, and the land is in first-class condition to receive the seeds, they should be sown broadcast at the rate of 40 lbs. per acre. A calm day should be chosen for the operation; then there will be no difficulty in distributing the seeds evenly over the land. This is important to ensure an even growth over the surface. After the sowing is finished draw light harrows over the ground to cover the seeds, and when this has been done, roll the whole with a light roller to firm the soil about the seed—that completes the operation. If favourable weather ensues, the young grass will be well above the ground in a fortnight or three weeks' from the time the seeds were sown. When the grass, growing on light, sandy loam is a few inches high it will be benefited by being rolled with a light roller, when the surface soil is dry and the weather fine. On no account should young permanent pasture be allowed to ripen seeds for the first two years at least, or the grasses will be weakened, and prematurely die out. The permanency of good pasture depends upon the treatment it receives, for the best grasses and forage plants will disappear if eaten too closely in dry, hot weather. All permanent pasture should be allowed to rest for at least three months of the year, to permit the herbage to recuperate and gain vigour. The best way to accomplish this, without depriving stock of their natural feed, is to lay out the pastures on such a plan that they can be systematically grazed in rotation.

GRASS MIXTURES FOR PERMANENT AND TEMPORARY PASTURES.

Following are tables of native and exotic grasses for permanent and temporary pastures including only those referred to in the previous pages. The grass seeds may be

sown alone or in mixtures in such proportions as the stock-owner thinks most suitable to his requirements. It occasionally happens that pastoralists and farmers have a prejudice for certain species which do well under the local climatic and soil conditions, and, of course, preference should be given to these. Whether sown alone or in mixtures 40 lbs. of good seed will be sufficient to sow an acre.

FOR THE WARMER COAST AREAS.

NATIVE GRASSES FOR PERMANENT PASTURE.

Australian Millet	Coolah Grass
Australian Rhodes Grass	Couch Grass
Blue Star Grass	Early Spring Grass
Brown Top	Kangaroo Grass
Coast Blue Grass	Wallaby Grass
Cockatoo Grass	Wild Sorghum

NATIVE GRASSES FOR TEMPORARY PASTURE.

Bent Grass	Landsborough Grass
Cockshin or Barn Yard Grass	Weeping Love Grass

FOR THE COOLER COAST AREAS.

NATIVE GRASSES FOR PERMANENT PASTURE.

Blue Star Grass	Kangaroo Grass
Branching Panick Grass	Love Grass
Coast Blue Grass	Meadow Rice Grass
Couch Grass	Wallaby Grass
Early Spring Grass	Wheat Grass

NATIVE GRASSES FOR TEMPORARY PASTURE.

Bent Grass	Weeping Love Grass
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FOR THE TABLE-LANDS AND COLDER DISTRICTS

NATIVE GRASSES FOR PERMANENT PASTURE.

Coast Blue Grass	Meadow Rice Grass
Hooker's Fescue	Wallaby Grass
Love Grass	Wheat Grass
Wild Sorghum	

NATIVE GRASSES FOR TEMPORARY PASTURE.

Bent Grass	Weeping Love Grass
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FOR THE INTERIOR.

NATIVE GRASSES FOR PERMANENT PASTURE.

Australian Millet	Mitchell Grass
Australian Rhodes Grass	Mulga Grass
Blue Grass	Plain-Grass
Brown Top	Satin Top
Coolah Grass	Silver Top
Coolibar Grass	Star Grass
Cotton Grass	Tall Oat Grass
Early Spring Grass	Umbrella Grass
Warrego Grass	Wallaby Grass

NATIVE GRASSES FOR TEMPORARY PASTURE.

Cockshin or Barn Yard Grass	Landsborough Grass
Weeping Love Grass	

EXOTIC GRASSES FOR PERMANENT PASTURE

IN THE COOLER AND COLDER PARTS OF AUSTRALIA.

The following grass seeds sown in the proportion given in the accompanying tables have resulted in good pasture for the different classes of land referred to:—

FOR DEEP RICH LOAMS.

Perennial Rye	..	..	..	12 lbs.
Meadow Foxtail	..	..	..	5 "
Prairie	..	..	..	5 "
Timothy	..	..	..	9 "
Cocksfoot	..	..	..	5 "
White Clover	..	..	..	2 "
Red Clover	..	..	..	2 "
				—
Weight of seed per acre	..	..	..	40 lbs.
				—

FOR HEAVY CLAYEY LAND.

Cocksfoot	..	..	..	15 lbs.
Perennial Rye	..	..	..	9 "
Timothy	..	..	..	8 "
Meadow Foxtail	..	..	..	1 "
White and Red Clover, 2 lbs. each	..	..	..	1 "
				—
Weight of seed per acre	..	..	..	40 lbs.

FOR PEATY SOILS.

Perennial Rye	..	..	..	12 lbs.
Cocksfoot	..	..	..	10 "
Meadow Foxtail	..	..	..	8 "
Timothy ..	..	..	..	8 "
White Clover	..	..	..	2 "
				—
Weight of seed per acre	..			40 lbs.
				—

FOR LIGHT OR SANDY SOILS.

Prairie ..	..	..	..	15 lbs.
Perennial Rye	..	..	..	15 "
Smooth Stalked Meadow Grass	..			6 "
White Clover	4 "
				—
Weight of seed per acre	..			40 lbs.
				—

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